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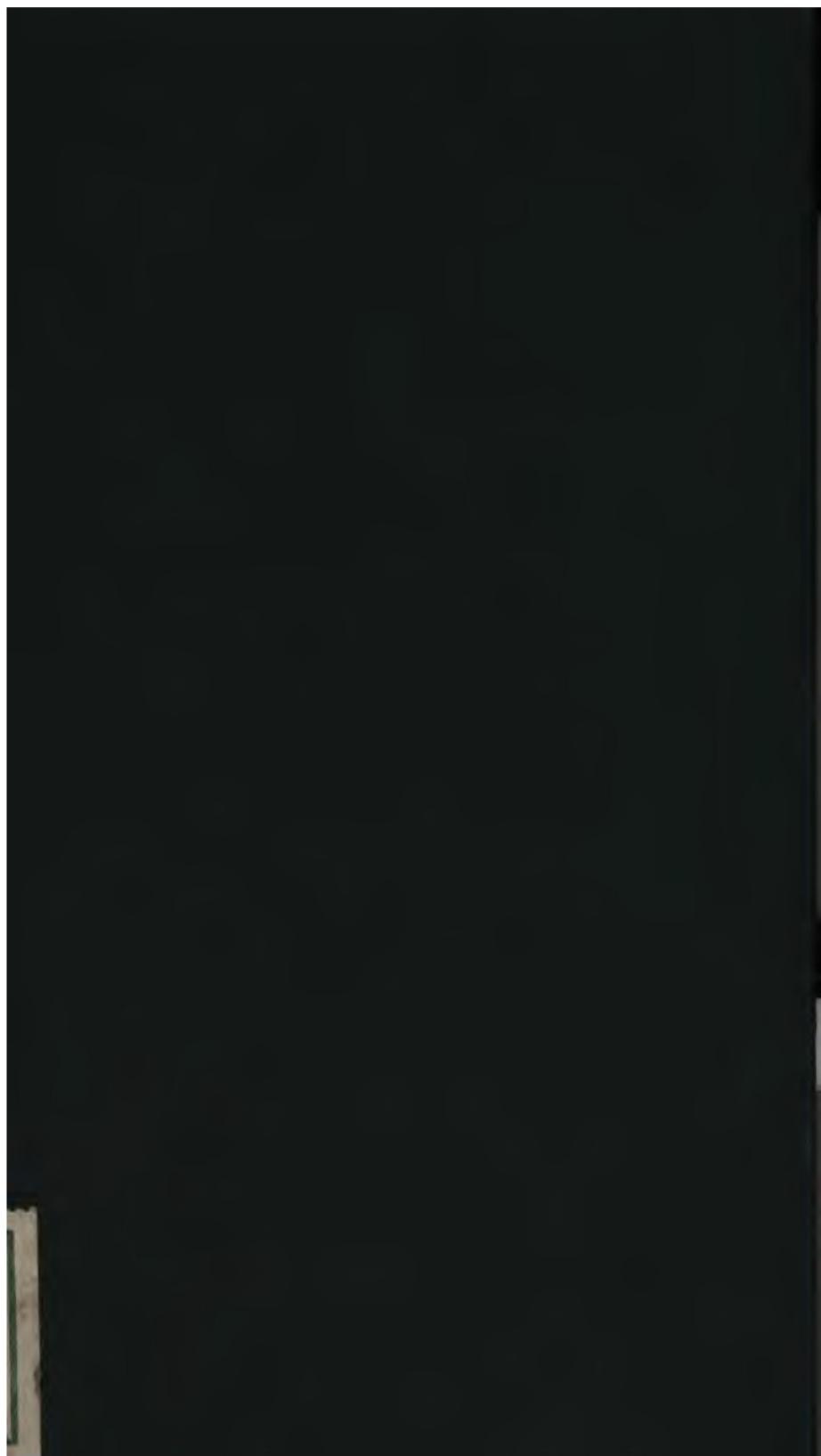
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A
K E Y

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TO

(Will.) TAYLOR'S
ARITHMETICIAN'S GUIDE:

CONTAINING

ANSWERS TO ALL THE QUESTIONS

IN THAT WORK;

WITH SOLUTIONS AT FULL LENGTH WHEREVER THERE
IS THE APPEARANCE OF DIFFICULTY.

By W. H. WHITE,

HEAD MASTER OF

THE COMMERCIAL AND MATHEMATICAL SCHOOL, BEDFORD:

AUTHOR OF

THE YOUNG STUDENT'S INTRODUCTION TO ARITHMETIC;
A COMPLETE COURSE OF ARITHMETIC;
&c. &c. &c.

LONDON:

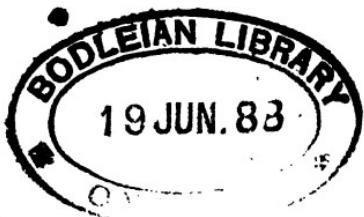
PRINTED FOR

LONGMAN, HURST, REES, ORME, AND BROWN,

PATERNOSTER-ROW.

1823.

1802. e. 40



Printed by A. and R. Spottiswoode,
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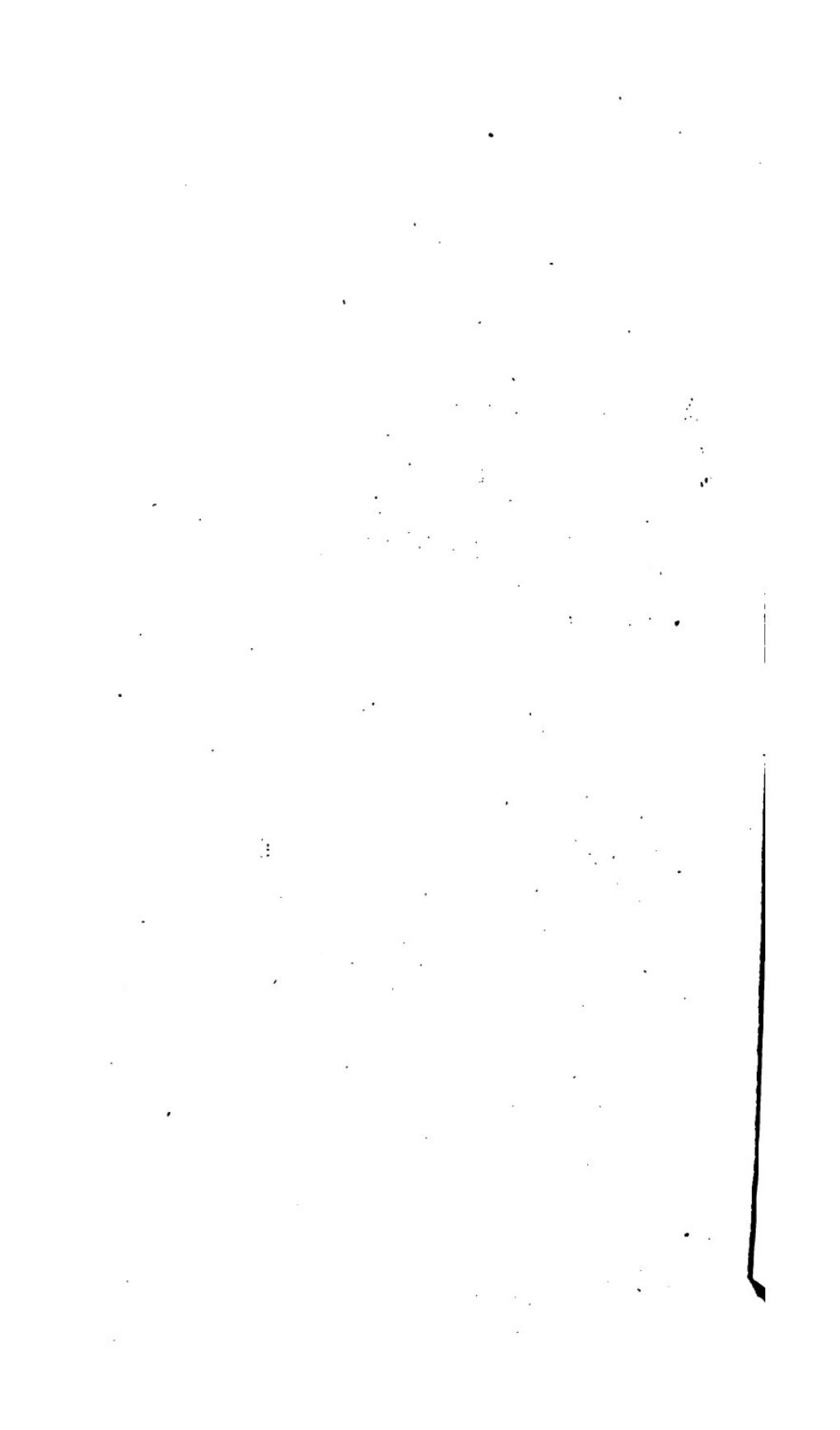
ADVERTISEMENT.

ALTHOUGH the title-page seems to explain the nature of the present volume, yet, as there is a considerable difference between the original Key, published by the Author of the *Arithmetician's Guide*, and the present work, it may not be amiss, briefly, to point out wherein that difference consists.

In the original Key, every question was worked at full length, and, in many cases, in a very long and tedious manner; in the present work, the questions are solved in the most concise and simple manner possible, by which means the progress of the pupil will be greatly facilitated and the labor of the Teacher infinitely lessened.

SELF STUDENTS, who make use of the *Arithmetician's Guide*, will best promote their progress by first solving the questions themselves, and then comparing their solutions with those contained in the following pages.

BEDFORD,
January 1. 1823.



K E Y

TO THE

ARITHMETICIAN'S GUIDE.

NUMERATION.

Numbers to be expressed in Words, answered.

- EXAMPLE (1) One thousand seven hundred and eighty-five.
(2) Three hundred twenty four thousand, five hundred and sixteen.
(3) Six hundred and fifteen thousand, four hundred and twenty-three.
(4) Seven millions six hundred and fifty-four thousand, three hundred and twenty-one.
(5) Eighty-seven million, six hundred and fifty-four thousand, three hundred and twenty-one.
(6) Nine hundred and eighty-seven million, six hundred and fifty-four thousand, three hundred and twenty-one.
(7) Four hundred and twenty-six thousand, seven hundred and eighty-four millions, three hundred and twenty-six thousand, five hundred and thirty-four.
(8) Six hundred and forty-two billions, one hundred and thirty-four thousand two hundred and ten millions, three hundred and forty-five thousand, six hundred and forty-eight.
(9) Two hundred thirty-four thousand five hundred and sixty-three billions, two hundred and fourteen thousand, three hundred and sixty-two millions, one hundred and fifty-six thousand, six hundred and thirty-four.

B

ADDITION.

(10) Fifty-four trillions, three hundred and twenty-six thousand four hundred and twenty-eight billions, nine hundred and sixteen thousand five hundred and forty-three millions, four hundred and sixty-five thousand, three hundred and forty-six.

(11) Eight hundred and sixty-four trillions, two hundred and fifteen thousand six hundred and forty-two billions, four hundred and sixty-eight millions, four thousand five hundred and sixty-two.

(12) Two quadrillions, one hundred and forty-six thousand, eight hundred and sixty-two trillions, eight hundred and ninety-eight thousand, seven hundred and sixty-four billions, eight hundred and forty-two thousand millions, six hundred and ninety-eight thousand and forty-two.

ADDITION:

Answers.

- | | | | | | | | |
|-----|-------|------|--------|------|--------|------|---------|
| (1) | 36 | (2) | 675 | (3) | 5040 | (4) | 8586 |
| (5) | 8460 | (6) | 7497 | (7) | 84987 | (8) | 66726 |
| (9) | 63369 | (10) | 747936 | (11) | 894861 | (12) | 1056069 |

As the proving of addition by the common method requires more time than the teacher can spare for that purpose, I have, in these examples, made every row of figures to end with nine, consequently, the total must do the same if the work be right; and by this method the pupil may be exercised with various other examples, until he is found sufficiently perfect.

Questions Answered.

(1) 34263	(2) 63	(3) 60
53163	8154	30
8172	6201	12
846	99	6
<hr/> 96444	<hr/> 14517	<hr/> 108 pence.

MULTIPLICATION.

3

(4) Jan.	31	(5) 1787	(6) 1787
Feb.	28	60	116
March	31	<hr/>	<hr/>
April	30	1847	1903
	<hr/>	<hr/>	<hr/>
	120 Days.		
	<hr/>		

SUBTRACTION.

Answers.

- (1) 74311348522 (2) 64202661111 (3) 46574614221
(4) 48775485155 (5) 32975113221 (6) 64204197581
(7) 63382135411 (8) 44463169266 [(9) 35330912534
(10) 46422219863 (11) 55011074745 (12) 22108765433

Questions answered.

(1) $\begin{array}{r} 1808 \\ - 1746 \\ \hline 62 \end{array}$ Years. (2) First $102 - 72 = 30$ Difference.
 Then $102 + 72 = 174$ Sum.

(3) $\begin{array}{r} 864952 \\ - 36842 \\ \hline 828110 \end{array}$ Less No. (4) $\begin{array}{r} 33905 \\ - 30624 \\ \hline 3281 \end{array}$ lbs. (5) $\begin{array}{r} 1808 \\ - 508 \\ \hline 1300 \end{array}$ Years.
(6) $\begin{array}{r} 1808 \\ - 1066 \\ \hline 742 \end{array}$ Years. (7) $\begin{array}{r} 1808 \\ - 1616 \\ \hline 192 \end{array}$ Years.

MULTIPLICATION.

Answers.

- (1) 8486429292 (2) 9370639062
(3) 21848582448 (4) 31862290815
(5) 14074073676 (6) 8641974663
(7) 17313883776 (8) 49335553467

MULTIPLICATION.

- | | |
|------------------------|------------------------|
| (9) 62132464530 | (10) 45447831495 |
| (11) 25445546064 | (12) 40617610956 |
| (13) 78483880467 | (14) 87635744856 |
| (15) 204139054440 | (16) 295522315974 |
| (17) 134985143979 | (18) 305073026784 |
| (19) 98575339824 | (20) 172245431448 |
| (21) 232688554038 | (22) 267964142976 |
| (23) 106928216424 | (24) 184069323018 |
| (25) 1496445909525 | (26) 761581139058 |
| (27) 1794031428420 | (28) 1991434833828 |
| (29) 20178289657152 | (30) 24385207418056 |
| (31) 9794086306128 | (32) 25999202980296 |
| (33) 40063332968757 | (34) 311528888892783 |
| (35) 145801426277250 | (36) 106210797330924 |
| (37) 1065808525174416 | (38) 1712262025232208 |
| (39) 12884970983029794 | (40) 5445418058704098 |
| (41) 59039041808423727 | (42) 59039041808423727 |

ABBREVIATIONS.

- | | |
|-------------------------|-------------------------|
| (43) 92545490355113808 | (44) 128285168943911427 |
| (45) 290256568722918000 | (46) 290256568722918000 |
| (47) 9876543210 | (48) 1987654300 |
| (49) 1987654000 | (50) 1987650000 |

BY PARTS.

- | | |
|-------------------|-------------------|
| (51) 1851851835 | (52) 10588682025 |
| (53) 11685734244 | (54) 35680 89608 |
| (55) 24669754632 | (56) 19543780683 |
| (57) 107714868228 | (58) 65667128112 |
| (59) 47093779264 | (60) 904785002496 |

DIVISION.

5

Questions Answered.

- (1) $89460 \times 50 = 4473000$.
 - (2) $40 \times 5 = 200$.
 - (3) $39 \times 20 = 780$ yards.
 - (4) $268 \times 118 = 31624$ soldiers.
 - (5) $235 \times 45 \times 50 = 528750$ letters.
 - (6) $10000 \times 5 = 50000$ persons.
 - (7) First $50 \times 50 = 2500$, square of 50; and $100 \times 20 = 2000$; then $2500 - 2000 = 500$, the number required.
-

DIVISION.

Answers.

- | | |
|---|--|
| (1) 4243214646 | (2) 3123546354 |
| (3) 5462145612 | (4) 6372458163 |
| (5) 2345678946 | (6) 1234567809 |
| (7) 2164235472 | (8) 5481728163 |
| (9) 6213246453 | (10) 4131621045 |
| (11) 2120462172 | (12) 312443161 quo. 2 rem. |
| (13) 341234262 $\frac{2}{3}$ $\frac{0}{3}$ | (14) 2434326246 |
| (15) 4536423432 | (16) 5472635481 |
| (17) 2142621338 | (18) 4237125372 |
| (19) 421262136 | (20) 531621702 |
| (21) 546217263 | (22) 728163432 |
| (23) 431162163 | (24) 324637254 |
| (25) 638143245 | (26) 234621423 |
| (27) 423620172 | (28) 542034522 |
| (29) 621405816 | (30) 534620438 |
| (31) 42354637 $\frac{4}{3}\frac{6}{1}\frac{2}{4}$ | (32) 61385472 $\frac{1}{4}\frac{6}{3}\frac{9}{4}\frac{1}{1}$ |
| (33) 12345678 $\frac{2}{3}\frac{9}{4}\frac{0}{5}\frac{6}{1}\frac{1}{3}$ | (34) 98765432 $\frac{3}{1}\frac{5}{4}\frac{4}{2}\frac{3}{3}$ |

COMPOUND ADDITION.

- (35) 6214232340
 (37) 23562043 ~~9~~⁰₄⁶₈²₃
 (39) 312471423
 (41) 123456789

- (36) 43232412 ~~1~~⁴₄⁷₈⁹₄
 (38) 31572816 ~~1~~⁶₄⁸₉¹₁
 (40) 478216243

ABBREVIATIONS.

- (42) 230040702
 (44) 720203400
 (46) 987654321
 (48) 1987654
- (43) 630702009
 (45) 403020270
 (47) 19876543
 (49) 198765

BY PARTS.

Ex. 50 is worked.

- (51) 324603729
 (53) 342635481
 (55) 816021729
 (57) 420480172
- (52) 637146243
 (54) 241281243
 (56) 456021723
 (58) 523602432

Questions answered.

- (1) $4473000 + 89460 = 50l.$
 (2) $200 + 40 = 5l.$ each man.
 (3) There are 20 pennyworth more of the last sort bought than of the first, and the remainder will fetch but 16d.; hence $20d. - 16d. = 4d.$ loss.
 (4) $31624 + 268 = 118$ men.
 (5) First, $528750 \div 50 = 10575$ lines; then $10575 \div 45 = 235$ pages.
 (6) $50000 + 5 = 10000$ persons.
 (7) First, $100 \times 20 = 2000$; and $50 \times 50 = 2500$; then $2500 - 2000 = 500$, the number required.
-

COMPOUND ADDITION.

Answers.

- | | | | | | | | | |
|---------------------------|-----------------|---------------------------|---------------------------|----------------|---------------------------|----------------------------|--------------------------|----------------|
| $\frac{\pounds}{(1)} 324$ | $\frac{s.}{12}$ | $\frac{d.}{6\frac{1}{4}}$ | $\frac{\pounds}{(2)} 354$ | $\frac{s.}{0}$ | $\frac{d.}{0\frac{1}{2}}$ | $\frac{\pounds}{(3)} 7666$ | $\frac{s.}{\frac{1}{4}}$ | $\frac{d.}{3}$ |
|---------------------------|-----------------|---------------------------|---------------------------|----------------|---------------------------|----------------------------|--------------------------|----------------|

COMPOUND ADDITION.

7

	<i>L.</i>	<i>s.</i>	<i>d.</i>		<i>L.</i>	<i>s.</i>	<i>d.</i>		<i>L.</i>	<i>s.</i>	<i>d.</i>
(4)	6461	0	1 $\frac{1}{2}$	(5)	6477	7	7 $\frac{1}{4}$	(6)	7216	9	3 $\frac{1}{2}$
(7)	6807	7	10 $\frac{1}{2}$	(8)	6024	8	7 $\frac{1}{2}$	(9)	5997	7	10 $\frac{1}{2}$
(10)	6015	8	9 $\frac{3}{4}$	(11)	6824	2	4 $\frac{1}{2}$	(12)	8922	6	1

TROY WEIGHT.

	<i>lb.</i>	<i>oz.</i>	<i>awt.</i>	<i>gr.</i>		<i>lb.</i>	<i>oz.</i>	<i>awt.</i>	<i>gr.</i>	
(13)	486	4	1	0		(14)	413	4	14	21

APOTHECARIES WEIGHT.

	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>gr.</i>		<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>gr.</i>	
(15)	68	3	1	2	17		(16)	76	2	1	0	15

AVOIRDUPOIS WEIGHT.

	<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>		<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	
(17)	69	6	0	12	2	3		(18)	77	9	0	9	15	5

CLOTH MEASURE.

	<i>Yds.</i>	<i>qr.</i>	<i>na.</i>		<i>E. Ells</i>	<i>qr.</i>	<i>na.</i>		<i>F. Ells</i>	<i>qr.</i>	<i>na.</i>		
(19)	623	1	0		(20)	622	1	3		(21)	817	1	2

LONG MEASURE.

	<i>Leag.</i>	<i>mi.</i>	<i>fur.</i>	<i>po.</i>		<i>Yds.</i>	<i>ft.</i>	<i>in.</i>	<i>b.c.</i>	
(22)	584	0	4	17		(23)	691	2	9	0

LAND MEASURE.

	<i>A.</i>	<i>R.</i>	<i>P.</i>		<i>A.</i>	<i>R.</i>	<i>P.</i>		<i>A.</i>	<i>R.</i>	<i>P.</i>		
(24)	583	3	12		(25)	620	0	25		(26)	692	2	35

WINE MEASURE.

	<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>		<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>	
(27)	96	3	46	3	1		(28)	95	3	53	1	0

ALE AND BEER MEASURE.

	<i>A. hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>		<i>B. hd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>	
(29)	582	29	1	1		(30)	613	26	1	1

DRY MEASURE.

	<i>Lasts qr. bu. pec. gal.</i>					<i>Lasts qr. bu. pec. gal.</i>				
(31)	86	7	2	1	0	(32)	95	0	0	2

TIME.

	<i>Years</i>	<i>mo.</i>	<i>w.</i>	<i>days</i>		<i>Days</i>	<i>ho.</i>	<i>mi.</i>	<i>sec.</i>	
(33)	794	2	0	6		(34)	875	21	46	29

MOTION.

	<i>S.</i>	<i>deg.</i>	"	"		<i>S.</i>	<i>deg.</i>	"	"		
(35)	107	9	56	56	18	(36)	95	1	11	52	22

COMPOUND ADDITION.

SQUARE MEASURE.

(37) Yds. ft. inch.
1091 6 114

Yds. ft. inch.
1015 6 104

SOLID MEASURE.

(39) Yds. ft. inch.
855 10 671

Yds. ft. inch.
970 18 749

Questions answered.

	(1)	(2)
Recd. of A	£ s. d.	£ s. d.
B	27 1 4	Wheat 23 12 6
C	12 6 8½	Rye 16 4 2
D	31 12 8	Oats 20 0 6
E	42 14 8½	Barley 38 14 6½
F	82 4 2	Car. 1 6 0
	41 16 3½	Commis. 3 10 6
Answer	237 15 10½	sum recd. 103 8 2½ ans.

	(3)	(4)
Paid in part	£ s. d.	£ s. d.
Remains unpaid	30 10 6	Officers 394 12 6
	42 2 4	Receive 240 0 0

Answer	72 12 10	Answer	634 12 6
--------	----------	--------	----------

	(5)	(6)
First cost	£ s. d.	£ s. d.
Packing	58 0 0	Rent 30 0 0
Carriage	0 10 6	Window lights 0 18 10½
Spent	1 7 0	Poor's rates 10 0 0
	0 6 8	Lamps, &c. 2 2 0
Answer	60 4 2	Answer 43 0 10½

COMPOUND SUBTRACTION.

9

COMPOUND SUBTRACTION.

Answers.

	<i>£</i>	<i>s.</i>	<i>d.</i>		<i>£</i>	<i>s.</i>	<i>d.</i>		<i>£</i>	<i>s.</i>	<i>d.</i>		
(1)	23	6	2½		(2)	17	6	3½		(3)	15	7	5½
(4)	21	11	9½		(5)	41	9	3½		(6)	18	1	11½
(7)	17	17	10½		(8)	26	18	6½					

TROY WEIGHT.

	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>		<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>	
(9)	72	2	9	9		(10)	46	3	7	4
(11)	74	9	17	4		(12)	73	1	12	9

APOTHECARIES WEIGHT.

	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>grs.</i>		<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>grs.</i>	
(13)	55	1	3	1	6		(14)	19	5	4	1	3
(15)	42	1	4	1	2		(16)	15	5	3	1	12

AVOIRDUPOIS WEIGHT.

	<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>		<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	
(17)	4	6	1	3	2	4		(18)	3	17	2	5	1	4
(19)	8	4	1	12	13	14		(20)	3	5	1	15	5	6

CLOTH MEASURE.

	<i>Yds.</i>	<i>qr.</i>	<i>na.</i>		<i>E.E.</i>	<i>qr.</i>	<i>na.</i>		<i>F.E.</i>	<i>qr.</i>	<i>na.</i>		
(21)	33	2	1		(22)	33	1	2		(23)	29	0	1
(24)	25	2	1		(25)	15	0	2		(26)	3	0	2

LONG MEASURE.

	<i>Leag.</i>	<i>mi.</i>	<i>fur.</i>	<i>po.</i>		<i>Yds.</i>	<i>ft.</i>	<i>in.</i>	<i>b. c.</i>	
(27)	44	1	2	15		(28)	33	1	2	1
(29)	19	1	1	14		(30)	47	0	1	2

LAND MEASURE.

	<i>A.</i>	<i>R.</i>	<i>P.</i>		<i>A.</i>	<i>R.</i>	<i>P.</i>		<i>A.</i>	<i>R.</i>	<i>P.</i>		
(31)	66	2	17		(32)	27	2	11		(33)	29	2	22
(34)	20	0	28		(35)	18	2	11		(36)	76	0	1

WINE MEASURE.

	<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>		<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>	
(37)	3	2	29	2	1		(38)	4	2	13	1	1
(39)	2	2	12	1	1		(40)	3	0	0	1	0

COMPOUND SUBTRACTION.

ALE AND BEER MEASURE.

	<i>A. hhd. gal.</i>	<i>qt.</i>	<i>pi.</i>		<i>A. hhd. gal.</i>	<i>qt.</i>	<i>pi.</i>
(41)	11	24	1	1	(42)	28	28
(43)	2	1	0	1	(44)	49	31

DRY MEASURE.

	<i>Lasts qr.</i>	<i>bu.</i>	<i>pec.</i>	<i>gal.</i>		<i>Lasts qr.</i>	<i>bu.</i>	<i>pec.</i>	<i>gal.</i>	
(45)	4	2	3	1	1	(46)	5	7	3	2
(47)	2	5	2	3	1	(48)	3	2	1	2

TIME.

	<i>Years</i>	<i>mo.</i>	<i>w.</i>	<i>days.</i>		<i>Days</i>	<i>ho.</i>	<i>mi.</i>	<i>sec.</i>
(49)	62	7	2	3		(50)	43	8	33
(51)	26	3	2	4		(52)	44	13	19

MOTION.

	<i>s.</i>	<i>o.</i>	<i>"</i>	<i>"</i>		<i>s.</i>	<i>o.</i>	<i>"</i>	<i>"</i>
(53)	5	4	15	30	5	(54)	4	15	27
(55)	8	13	27	34	35	(56)	4	16	33

SQUARE MEASURE.

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>			<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(57)	30	2	115			(58)	67	4
(59)	24	5	22			(60)	33	5

SOLID MEASURE.

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>			<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(61)	2	13	233			(62)	2	11
(63)	4	6	658			(64)	5	2

Questions Answered.

	<i>(1)</i>			<i>(2)</i>		
From	<i>£</i>	<i>s.</i>	<i>d.</i>	Lent	<i>£</i>	<i>s.</i>
	86	0	6 $\frac{3}{4}$		200	0
Take	31	18	11	Recd. by goods	84	6
Differ.	54	1	7 $\frac{1}{4}$	Remains due	115	13
	<hr/>	<hr/>	<hr/>		<hr/>	<hr/>
	<i>(3)</i>	<i>(4)</i>				
From	18308	1508	House & furniture	1100	8	4 $\frac{1}{2}$
Take	2118	+610	House	742	10	6
Diff.	16190	<hr/>	Furniture cost	357	17	10 $\frac{1}{2}$
	<hr/>	<hr/>		<hr/>	<hr/>	<hr/>

COMPOUND MULTIPLICATION.

11

		<i>Years m. w. d. h. m.</i>
(5)	From	21 0 0 0 0 0
	Take	14 12 11 10 9 8
	To serve	5 10 3 3 14 52 Ans.

<i>Debtor</i>	<i>£ s. d.</i>	<i>(6)</i>	<i>Creditor</i>
To A.	86 10 6	By cash	10 0 0
B.	36 0 0	Commodities	21 12 0
C.	20 12 4½	Housh. furniture	42 0 6
D.	56 18 0	Book debts	62 13 6
E.	10 10 3	Plate	12 4 4
F.	86 8 6		148 10 4
Debtor	296 19 7½		_____
Creditor	148 10 4		_____
Answer	148 9 3½		_____

COMPOUND MULTIPLICATION.

Answers.

(1) 0 16 4 3	(2) 0 7 3 4	(3) 0 1 2 5
Ans. 2 9 0	1 9 0	0 5 10
(4) 0 0 7½ 6	(5) 9 6 7	(6) 0 2 4 8
0 3 9	3 6 6	0 18 8
(7) 0 1 9 9	(8) 0 2 2½ 10	(9) 2 1 4 11
0 15 9	1 2 1	22 14 8
	B 6	

12 COMPOUND MULTIPLICATION

$$(10) \begin{array}{r} \text{£} \quad s. \quad d. \\ 1 \quad 4 \quad 3 \\ \times 12 \\ \hline 14 \quad 11 \quad 0 \end{array}$$

$$(11) \begin{array}{r} \text{£} \quad s. \quad d. \\ 0 \quad 17 \quad 6 \\ \times 2 \times 7 = 14 \\ \hline 1 \quad 15 \quad 0 \\ \hline 7 \\ \hline 12 \quad 5 \quad 0 \end{array}$$

$$(12) \begin{array}{r} \text{£} \quad s. \quad d. \\ 7 \quad 10 \frac{1}{2} \\ \times 3 \times 5 = 15 \\ \hline 1 \quad 3 \quad 7 \frac{1}{2} \\ \hline 5 \\ \hline 5 \quad 18 \quad 1 \frac{1}{2} \end{array}$$

$$(13) \begin{array}{r} \text{£} \quad s. \\ 1 \quad 7 \\ \times 4 \times 4 = 16 \\ \hline 5 \quad 8 \\ \hline 4 \\ \hline 21 \quad 12 \end{array}$$

	Sums.	Multipliers.	Products.			
	£	s.	d.	£	s.	d.
(14)	0	17	6	$\times 3 \times 6$	=	15 15 0
(15)	1	18	8	$\times 4 \times 5$	=	38 13 4
(16)	5	7 $\frac{1}{2}$	$\times 3 \times 7$	=	5 18	1 $\frac{1}{2}$
(17)	5	11	4	$\times 2 \times 11$	=	122 9 4
(18)	4	7	2	$\times 4 \times 6$	=	104 12 0
(19)	4	6	$\times 5 \times 5$	=	5 12	6
(20)	5	11 $\frac{1}{2}$	$\times 3 \times 9$	=	8 0	10 $\frac{1}{2}$
(21)	2	8	$\times 4 \times 7$	=	3 14	8
(22)	1	12	0	$\times 6 \times 5$	=	48 0 0
(23)	1	9	$\times 4 \times 8$	=	2 16	0
(24)	1	2	0	$\times 3 \times 11$	=	36 6 0
(25)	1	2	6	$\times 5 \times 7$	=	39 7 6
(26)	6	2 $\frac{1}{2}$	$\times 6 \times 6$	=	11 3	6
(27)	1	12	6	$\times 5 \times 8$	=	65 0 0
(28)	6	4 $\frac{1}{2}$	$\times 6 \times 7$	=	13 7	9

COMPOUND MULTIPLICATION.

19

	<i>Sums.</i>	<i>Multipliers.</i>	<i>Products.</i>			
	<i>£</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>
(29)	19	10	$\times 4 \times 11 =$	43	12	8
(30)	19	4	$\times 5 \times 9 =$	43	10	0
(31)	3	7	$\times 6 \times 8 =$	8	12	0
(32)	2	5½	$\times 5 \times 10 =$	6	2	11
(33)	1	16	$\times 6 \times 9 =$	98	11	0
(34)	1	10	$\times 5 \times 11 =$	82	10	0
(35)	1	2	$\times 7 \times 8 =$	63	0	0
(36)	6	9	$\times 6 \times 10 =$	20	5	0
(37)	4	3	$\times 7 \times 9 =$	13	7	9
(38)	4	8	$\times 8 \times 8 =$	14	18	8
(39)	1	6½	$\times 6 \times 11 =$	5	1	9
(40)	1	4	$\times 7 \times 10 =$	4	13	4
(41)	1	8	$\times 8 \times 9 =$	6	0	0
(42)	3	2½	$\times 7 \times 11 =$	12	5	5½
(43)	3	6	$\times 8 \times 10 =$	14	0	0
(44)	0	7½	$\times 9 \times 9 =$	2	10	7½
(45)	21	4	$\times 7 \times 12 =$	1782	18	0
(46)	4	6	$\times 8 \times 11 =$	19	16	0
(47)	6	0	$\times 10 \times 9 =$	27	0	0
(48)	2	10	$\times 8 \times 12 =$	240	0	0
(49)	8	10	$\times 9 \times 11 =$	841	10	0
(50)	17	0	$\times 10 \times 10 =$	85	0	0
(51)	5	6	$\times 9 \times 12 =$	29	14	0
(52)	1	10	$\times 10 \times 11 =$	10	1	8
(53)	2	8	$\times 10 \times 12 =$	16	0	0
(54)	1	2	$\times 11 \times 11 =$	7	1	2
(55)	2	4	$\times 11 \times 12 =$	15	8	0
(56)	2	2	$\times 12 \times 12 =$	15	12	0
(57)	0	4½	$\times 8 \times 7 \times 2 =$	1	19	8
(58)	0	3½	$\times 8 \times 7 \times 4 =$	3	5	4

COMPOUND MULTIPLICATION.

	<i>Sums.</i>			<i>Multiplicers.</i>	<i>Products.</i>		
	<i>£</i>	<i>s.</i>	<i>d.</i>		<i>£</i>	<i>s.</i>	<i>d.</i>
(59)	0	5	½	$\times 8 \times 7 \times 6 =$	7	14	0
(60)	5	4	0	$\times 10 \times 9 \times 4 =$	96	0	0
(61)	1	4	0	$\times 8 \times 7 \times 10 =$	37	6	8
(62)	1	2	2	$\times 12 \times 12 \times 12 = 1915$	4	0	0
(63)	5	6	0	$\times 4 \times 4 + 1 =$	4	13	6
(64)	3	6	0	$\times 3 \times 7 + 2 =$	4	0	6
(65)	14	6	0	$\times 4 \times 7 + 1 =$	21	0	6
(66)	3	6	0	$\times 5 \times 7 - 1 =$	5	19	0
(67)	0	9	0	$\times 6 \times 6 + 1 =$	1	7	9
(68)	2	2	0	$\times 6 \times 7 + 1 =$	4	18	2
(69)	12	6	½	$\times 5 \times 8 - 1 =$	24	9	1½
(70)	1	6	½	$\times 5 \times 9 + 2 =$	3	12	5½
(71)	0	9	0	$\times 6 \times 9 - 1 =$	1	19	9
(72)	6	6	0	$\times 6 \times 10 - 1 =$	19	3	6
(73)	1	8	0	$\times 7 \times 10 + 1 =$	5	18	4
(74)	4	8	0	$\times 9 \times 9 + 2 =$	19	7	4
(75)	6	8	0	$\times 8 \times 11 + 1 =$	29	13	4
(76)	6	8	0	$\times 8 \times 12 + 1 =$	32	6	8
(77)	8	2	0	$\times 9 \times 12 - 2 =$	43	5	8
(78)	10	2	0	$\times 9 \times 12 + 1 =$	55	8	2
(79)	5	6	½	$\times 11 \times 11 + 2 =$	34	1	7½
(80)	1	3	2	$\times 12 \times 12 + 1 =$	167	19	2
(81)	0	9	0	$\times 5 \times 5 + \frac{1}{2} =$	0	18	1½
(82)	2	4	½	$\times 5 \times 6 + \frac{1}{2} =$	3	12	5½
(83)	1	10	6	$\times 5 \times 7 + \frac{3}{2} =$	54	10	4½
(84)	32	2	6	$\times 5 \times 8 + \frac{1}{2} =$	1301	1	3
(85)	2	12	0	$\times 8 \times 8 + \frac{1}{2} =$	167	1	0
(86)	1	4	0	$\times 9 \times 9 + \frac{1}{2} =$	97	16	0
(87)	2	4	0	$\times 9 \times 12 + \frac{1}{2} =$	12	12	7
(88)	6	8	½	$\times 12 \times 10 + \frac{1}{2} =$	40	8	4½

COMPOUND DIVISION.

15

	Sums.			Multipliers.			Products.				
	£	s.	d.		£	s.	d.		£	s.	d.
(89)	1	4	$\times 12 \times 11 + \frac{1}{2}$	=	8	16	4				
(90)	9	2	$\times 12 \times 12 + \frac{1}{2}$	=	66	4	7				
(91)	1	5	$6 \times 10 \times 11 + 7\frac{1}{4}$	=	149	9	$10\frac{1}{2}$				
(92)	12	$9\frac{1}{2}$	$\times 12 \times 12 + 1\frac{1}{2}$	=	93	1	$2\frac{1}{2}$				
(93)	1	4	$10\frac{1}{4} \times 10 \times 9 \times 4 + 5 = 453$	11	9	$1\frac{1}{4}$					
(94)	362	10	$6\frac{1}{2} \times 12 + 1\frac{1}{2}$	=	4894	2	$3\frac{1}{2}$				
(95)	4	4	$3\frac{1}{4} \times 10 \times 10 \times 10 \times 9 + 652 = 40669$	2	1						
(96)	3	2	$6\frac{1}{4} \times 10 \times 9 \times 4 + 5 = 1141$	0	$1\frac{1}{4}$	ann. ex.					
				2264	0	0	yly. in.				
					1122	19	$10\frac{1}{4}$	helaysup.			

	Cwt.	qr.	lb.	ox.	dr.		Cwt.	qr.	lb.	ox.	dr.
(97)	14	0	21	0	$14 \times 7 =$	=	99	1	7	6	2
	lb.	ox.	dr.	sc.	gr.		lb.	ox.	dr.	sc.	gr.
(98)	10	6	4	1	$17 \times 9 =$	=	94	11	1	1	13
	Cwt.	qr.	lb.				Cwt.	qr.	lb.		
(99)	8	1	21	$\times 6 \times 6 + 1 =$			312	0	21		
(100)	9	1	$12 \times 9 \times 12 + 1 =$	1019	3	20					
	lb.	ox.	dwt.	grs.			lb.	ox.	dwt.	grs.	
(101)	4	6	8	$3 \times 4 =$			18	1	12	12	

COMPOUND DIVISION.

Answers.

(1)	£	s.	d.	(2)	£	s.	d.	(3)	£	s.	d.
(1)	3)2	9	0	(2)	4)1	9	0	(3)	5)0	5	10
Ans.	0	16	4		0	7	3		0	1	2
(4)	6)0	3	9	(5)	7)3	6	6	(6)	8)0	18	8
	0	0	$7\frac{1}{2}$		0	9	6		0	2	4

COMPOUND DIVISION.

$$(7) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 9) 0 \ 15 \ 9 \\ \hline 0 \ 1 \ 9 \end{array}$$

$$(8) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 10) 1 \ 2 \ 1 \\ \hline 0 \ 2 \ 2\frac{1}{2} \end{array}$$

$$(9) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 11) 22 \ 14 \ 8 \\ \hline 2 \ 1 \ 4 \end{array}$$

$$(10) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 12) 14 \ 11 \ 0 \\ \hline 1 \ 4 \ 3 \end{array}$$

$$(11) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 7) 12 \ 5 \ 0 \\ \hline 2) 1 \ 15 \ 0 \\ \hline 0 \ 17 \ 6 \end{array}$$

$$(12) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 5) 5 \ 18 \ 1\frac{1}{2} \\ \hline 3) 1 \ 3 \ 7\frac{1}{2} \\ \hline 0 \ 7 \ 10\frac{1}{2} \end{array}$$

$$(13) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 4) 21 \ 12 \ 0 \\ \hline 4) 5 \ 8 \ 0 \\ \hline 1 \ 7 \ 0 \end{array}$$

$$(14) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 6) 15 \ 15 \ 0 \\ \hline 3) 2 \ 12 \ 6 \\ \hline 0 \ 17 \ 6 \end{array}$$

$$(15) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 20) 38 \ 13 \ 4 \\ \hline 4) 7 \ 14 \ 8 \\ \hline 1 \ 18 \ 8 \end{array}$$

$$(16) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 21) 5 \ 18 \ 1\frac{1}{2} \\ \hline 3) 0 \ 16 \ 10\frac{1}{2} \\ \hline 0 \ 5 \ 7\frac{1}{2} \end{array}$$

$$(17) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 22) 122 \ 9 \ 4 \\ \hline 2) 11 \ 2 \ 8 \\ \hline 5 \ 11 \ 4 \end{array}$$

$$(18) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 24) 104 \ 12 \ 0 \\ \hline 4) 17 \ 8 \ 8 \\ \hline 4 \ 7 \ 2 \end{array}$$

$$(19) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 25) 5 \ 12 \ 6 \\ \hline 5) 1 \ 2 \ 6 \\ \hline 0 \ 4 \ 6 \end{array}$$

$$(20) \begin{array}{r} \cancel{\pounds} \ s. \ d. \\ 27) 8 \ 0 \ 10\frac{1}{2} \\ \hline 3) 0 \ 17 \ 10\frac{1}{2} \\ \hline 0 \ 5 \ 11\frac{1}{2} \end{array}$$

COMPOUND DIVISION.

17

$$(21) \quad 28 \left\{ \begin{array}{r} 7) \begin{array}{rrr} \mathcal{L} & s. & d. \\ 3 & 14 & 8 \\ \hline 0 & 10 & 8 \\ \hline 0 & 2 & 8 \end{array} \\ 4) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(22) \quad 30 \left\{ \begin{array}{r} 5) \begin{array}{rrr} \mathcal{L} & s. & d. \\ 48 & 0 & 0 \\ \hline 9 & 12 & 0 \\ \hline 1 & 12 & 0 \end{array} \\ 6) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(23) \quad 32 \left\{ \begin{array}{r} 8) \begin{array}{rrr} 2 & 16 & 0 \\ \hline 0 & 7 & 0 \\ \hline 0 & 1 & 9 \end{array} \\ 4) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(24) \quad 33 \left\{ \begin{array}{r} 11) \begin{array}{rrr} 36 & 6 & 0 \\ \hline 3 & 6 & 0 \\ \hline 1 & 2 & 0 \end{array} \\ 3) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(25) \quad 35 \left\{ \begin{array}{r} 7) \begin{array}{rrr} 39 & 7 & 6 \\ \hline 5 & 12 & 6 \\ \hline 1 & 2 & 6 \end{array} \\ 5) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(26) \quad 36 \left\{ \begin{array}{r} 6) \begin{array}{rrr} 11 & 3 & 6 \\ \hline 1 & 17 & 3 \\ \hline 0 & 6 & 2\frac{1}{2} \end{array} \\ 6) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(27) \quad 40 \left\{ \begin{array}{r} 8) \begin{array}{rrr} 65 & 0 & 0 \\ \hline 5 & 2 & 6 \\ \hline 1 & 12 & 6 \end{array} \\ 5) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(28) \quad 42 \left\{ \begin{array}{r} 7) \begin{array}{rrr} 13 & 7 & 9 \\ \hline 1 & 18 & 3 \\ \hline 0 & 6 & 4\frac{1}{2} \end{array} \\ 6) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(29) \quad 44 \left\{ \begin{array}{r} 11) \begin{array}{rrr} 43 & 12 & 8 \\ \hline 4) \end{array} \\ 3) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(30) \quad 45 \left\{ \begin{array}{r} 9) \begin{array}{rrr} 43 & 10 & 0 \\ \hline 4 & 16 & 8 \\ \hline 0 & 19 & 4 \end{array} \\ 5) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(31) \quad 48 \left\{ \begin{array}{r} 8) \begin{array}{rrr} 8 & 12 & 0 \\ \hline 6) \end{array} \\ 1) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

$$(32) \quad 50 \left\{ \begin{array}{r} 10) \begin{array}{rrr} 6 & 2 & 11 \\ \hline 5) \end{array} \\ 0) \end{array} \right. \quad \begin{array}{l} \\ \\ \end{array}$$

COMPOUND DIVISION.

$$(33) \quad 54 \left\{ \begin{array}{r} \text{£} \ s. \ d. \\ 9) 98 \ 11 \ 0 \\ \hline 6) 10 \ 19 \ 0 \\ \hline 1 \ 16 \ 6 \end{array} \right.$$

$$(34) \quad 55 \left\{ \begin{array}{r} \text{£} \ s. \ d. \\ 11) 82 \ 10 \ 0 \\ \hline 5) 7 \ 10 \ 0 \\ \hline 1 \ 10 \ 0 \end{array} \right.$$

$$(35) \quad 56 \left\{ \begin{array}{r} 8) 63 \ 0 \ 0 \\ \hline 7) 7 \ 17 \ 6 \\ \hline 1 \ 2 \ 6 \end{array} \right.$$

$$(36) \quad 60 \left\{ \begin{array}{r} 10) 20 \ 5 \ 0 \\ \hline 6) 2 \ 0 \ 6 \\ \hline 0 \ 6 \ 9 \end{array} \right.$$

$$(37) \quad 63 \left\{ \begin{array}{r} 9) 13 \ 7 \ 9 \\ \hline 7) 1 \ 9 \ 9 \\ \hline 0 \ 4 \ 3 \end{array} \right.$$

$$(38) \quad 64 \left\{ \begin{array}{r} 8) 14 \ 18 \ 8 \\ \hline 8) 1 \ 17 \ 4 \\ \hline 0 \ 4 \ 8 \end{array} \right.$$

$$(39) \quad 66 \left\{ \begin{array}{r} 11) 5 \ 1 \ 9 \\ \hline 6) 0 \ 9 \ 3 \\ \hline 0 \ 1 \ 6 \frac{1}{2} \end{array} \right.$$

$$(40) \quad 70 \left\{ \begin{array}{r} 10) 4 \ 13 \ 4 \\ \hline 7) 0 \ 9 \ 4 \\ \hline 0 \ 1 \ 4 \end{array} \right.$$

$$(41) \quad 72 \left\{ \begin{array}{r} 9) 6 \ 0 \ 0 \\ \hline 8) 0 \ 13 \ 4 \\ \hline 0 \ 1 \ 8 \end{array} \right.$$

$$(42) \quad 77 \left\{ \begin{array}{r} 11) 12 \ 5 \ 5 \frac{1}{4} \\ \hline 7) 1 \ 2 \ 3 \frac{3}{4} \\ \hline 0 \ 3 \ 2 \frac{1}{4} \end{array} \right.$$

$$(43) \quad 80 \left\{ \begin{array}{r} 10) 14 \ 0 \ 0 \\ \hline 8) 1 \ 8 \ 0 \\ \hline 0 \ 3 \ 6 \end{array} \right.$$

$$(44) \quad 81 \left\{ \begin{array}{r} 9) 2 \ 10 \ 7 \frac{1}{2} \\ \hline 9) 0 \ 5 \ 7 \frac{1}{2} \\ \hline 0 \ 0 \ 7 \frac{1}{2} \end{array} \right.$$

COMPOUND DIVISION.

19

$$(45) \quad 84 \left\{ \begin{array}{r} \cancel{2} \ 1782 \ 18 \ 0 \\ 12) \underline{148} \ 11 \ 6 \\ \underline{21} \ 4 \ 6 \end{array} \right.$$

$$(46) \quad 88 \left\{ \begin{array}{r} \cancel{2} \ 19 \ 16 \ 0 \\ 11) \underline{16} \ 0 \\ 0 \ 4 \ 6 \end{array} \right.$$

$$(47) \quad 90 \left\{ \begin{array}{r} 9) 27 \ 0 \ 0 \\ 10) \underline{3} \ 0 \ 0 \\ 0 \ 6 \ 0 \end{array} \right.$$

$$(48) \quad 96 \left\{ \begin{array}{r} 12) 240 \ 0 \ 0 \\ 8) \underline{20} \ 0 \ 0 \\ 2 \ 10 \ 0 \end{array} \right.$$

$$(49) \quad 99 \left\{ \begin{array}{r} 11) 841 \ 10 \ 0 \\ 9) \underline{76} \ 10 \ 0 \\ 8 \ 10 \ 0 \end{array} \right.$$

$$(50) \quad 100 \left\{ \begin{array}{r} 10) 85 \ 0 \ 0 \\ 10) \underline{8} \ 10 \ 0 \\ 0 \ 17 \ 0 \end{array} \right.$$

$$(51) \quad 108 \left\{ \begin{array}{r} 12) 29 \ 14 \ 0 \\ 9) \underline{2} \ 9 \ 6 \\ 0 \ 5 \ 6 \end{array} \right.$$

$$(52) \quad 110 \left\{ \begin{array}{r} 11) 10 \ 1 \ 8 \\ 10) \underline{0} \ 18 \ 4 \\ 0 \ 1 \ 10 \end{array} \right.$$

$$(53) \quad 120 \left\{ \begin{array}{r} 12) 16 \ 0 \ 0 \\ 10) \underline{1} \ 6 \ 8 \\ 0 \ 2 \ 8 \end{array} \right.$$

$$(54) \quad 121 \left\{ \begin{array}{r} 11) 7 \ 1 \ 2 \\ 11) \underline{0} \ 12 \ 10 \\ 0 \ 1 \ 2 \end{array} \right.$$

$$(55) \quad 132 \left\{ \begin{array}{r} 12) 15 \ 8 \ 0 \\ 11) \underline{1} \ 5 \ 8 \\ 0 \ 2 \ 4 \end{array} \right.$$

$$(56) \quad 144 \left\{ \begin{array}{r} 12) 15 \ 12 \ 0 \\ 12) \underline{1} \ 6 \ 0 \\ 0 \ 2 \ 2 \end{array} \right.$$

COMPOUND DIVISION.

$$(57) \quad \begin{array}{r} \ell \ s. \ d. \\ 2) 1 \ 19 \ 8 \\ \hline 7) 0 \ 19 \ 10 \\ \hline 8) 0 \ 2 \ 10 \\ \hline 0 \ 0 \ 4\frac{1}{4} \\ \hline \end{array}$$

$$(58) \quad \begin{array}{r} \ell \ s. \ d. \\ 4) 3 \ 5 \ 4 \\ \hline 7) 0 \ 16 \ 4 \\ \hline 8) 0 \ 2 \ 4 \\ \hline 0 \ 0 \ 3\frac{1}{4} \\ \hline \end{array}$$

$$(59) \quad \begin{array}{r} \ell \ s. \ d. \\ 6) 7 \ 14 \ 0 \\ \hline 7) 1 \ 5 \ 8 \\ \hline 8) 0 \ 3 \ 8 \\ \hline 0 \ 0 \ 5\frac{1}{2} \\ \hline \end{array}$$

$$(60) \quad \begin{array}{r} \ell \ s. \ d. \\ 4) 96 \ 0 \ 0 \\ \hline 9) 24 \ 0 \ 0 \\ \hline 10) 2 \ 13 \ 4 \\ \hline 0 \ 5 \ 4 \\ \hline \end{array}$$

$$(61) \quad \begin{array}{r} \ell \ s. \ d. \\ 10) 37 \ 6 \ 8 \\ \hline 7) 3 \ 14 \ 8 \\ \hline 8) 0 \ 10 \ 8 \\ \hline 0 \ 1 \ 4 \\ \hline \end{array}$$

$$(62) \quad \begin{array}{r} \ell \ s. \ d. \\ 12) 1915 \ 4 \ 0 \\ \hline 12) 159 \ 12 \ 0 \\ \hline 12) 13 \ 6 \ 0 \\ \hline 1 \ 2 \ 2 \\ \hline \end{array}$$

$$(63) \quad \begin{array}{r} \ell \ s. \ d. \\ 10) 4 \ 13 \ 6 \\ \hline 7) 0 \ 9 \ 4\frac{2}{5} \\ \hline 0 \ 1 \ 4\frac{2}{5} \\ \hline \end{array}$$

COMPOUND DIVISION.

21

$$(64) \quad \begin{array}{r} \text{£} \text{ s. } \text{d.} \\ 4 \ 0 \ 6 \\ \hline 20 \end{array}$$

$$23) \overline{80} (\begin{array}{r} 3 \ 6 \text{ Ans.} \\ 69 \\ \hline 11 \\ 12 \end{array}$$

$$23) \overline{138} (\begin{array}{r} 6 \\ 138 \\ \hline \end{array}$$

$$(65) \quad \begin{array}{r} \text{£} \text{ s. } \text{d.} \\ 21 \ 0 \ 6 \\ \hline 20 \end{array}$$

$$29) \overline{420} (\begin{array}{r} 14 \ 6 \text{ Ans.} \\ 406 \\ \hline 14 \\ 12 \end{array}$$

$$29) \overline{174} (\begin{array}{r} 6 \\ 174 \\ \hline \end{array}$$

$$(66) \quad \begin{array}{r} \text{£} \text{ s. } \text{d.} \\ 5 \ 19 \ 0 + 34 = 0 \ 3 \ 6 \text{ Ans.} \end{array}$$

$$(67) \quad 1 \ 7 \ 9 \div 37 = \quad \quad \quad 9$$

$$(68) \quad 4 \ 13 \ 2 + 43 = \quad \quad \quad 2 \ 2$$

$$(69) \quad 24 \ 9 \ 1\frac{1}{2} \div 39 = \quad 12 \ 6\frac{1}{2}$$

$$(70) \quad 3 \ 12 \ 5\frac{1}{2} + 47 = \quad 1 \ 6\frac{1}{2}$$

$$(71) \quad 1 \ 16 \ 9 \div 53 = \quad \quad \quad 9$$

$$(72) \quad 19 \ 3 \ 6 \div 59 = \quad \quad \quad 6 \ 6$$

$$(73) \quad 5 \ 18 \ 4 \div 71 = \quad \quad \quad 1 \ 8$$

$$(74) \quad 19 \ 7 \ 4 \div 83 = \quad \quad \quad 4 \ 8$$

$$(75) \quad 29 \ 13 \ 4 \div 89 = \quad \quad \quad 6 \ 8$$

$$(76) \quad 32 \ 6 \ 8 \div 97 = \quad \quad \quad 6 \ 8$$

$$(77) \quad 43 \ 5 \ 8 \div 106 = \quad \quad \quad 8 \ 2$$

$$(78) \quad 55 \ 8 \ 2 \div 109 = \quad \quad \quad 10 \ 2$$

$$(79) \quad 34 \ 1 \ 7\frac{1}{2} \div 123 = \quad \quad \quad 5 \ 6\frac{1}{2}$$

$$(80) \quad 167 \ 19 \ 2 + 145 = 1 \ 3 \ 2$$

$$(81) \quad 0 \ 18 \ 11\frac{1}{4} + 25\frac{1}{4} = \quad \quad \quad 9$$

$$(82) \quad 3 \ 12 \ 5\frac{1}{4} \div 30\frac{1}{2} = \quad \quad \quad 2 \ 4\frac{1}{2}$$

$$(83) \quad 54 \ 10 \ 4\frac{1}{2} \div 35\frac{3}{4} = 1 \ 10 \ .6$$

$$(84) \quad 1301 \ 1 \ 3 \div 40\frac{1}{2} = 32 \ 2 \ .6$$

$$(85) \quad 167 \ 1 \ 0 + 64\frac{1}{4} = 2 \ 12 \ - 0$$

COMPOUND DIVISION

	\pounds	s.	d.		\pounds	s.	d.
(86)	97	16	0	$\div 81\frac{1}{2} =$	1	4	0 Ans.
(87)	12	12	7	$\div 108\frac{1}{4} =$	2	4	
(88)	40	8	$4\frac{1}{4}$	$\div 120\frac{1}{2} =$	6	$8\frac{1}{2}$	
(89)	8	16	4	$\div 132\frac{1}{2} =$	1	4	
(90)	66	4	7	$\div 144\frac{1}{2} =$	9	2	
(91)	149	9	$10\frac{1}{2}$	$\div 117\frac{1}{4} =$	1	5	6
(92)	93	1	$2\frac{1}{4}$	$\div 145\frac{1}{2} =$	0	12	$9\frac{1}{2}$
(93)	453	11	$9\frac{1}{4}$	$\div 365 =$	1	4	$10\frac{1}{4}$
(94)	4894	2	$3\frac{1}{4}$	$\div 13\frac{1}{2} =$	362	10	$6\frac{1}{2}$
(95)	40669	2	1	$\div 9652 =$	4	4	$3\frac{1}{4}$

$$(96) \text{ First } 2264 - 1122 \ 19 \ 10\frac{3}{4} = 1141 \ 0 \ 1\frac{1}{4}$$

he spends per annum.

$$\text{Then } 1141 \ 0 \ 1\frac{1}{4} + 365 = 3 \ 2 \ 6\frac{1}{4}$$

he spends per day.

$$(97) \begin{array}{ccccccccc} Cwt. & qr. & lb. & oz. & drs. & & Cwt. & lb. & drs. \\ 99 & 1 & 7 & 6 & 2 & \div 7 = & 14 & 21 & 14 \end{array}$$

$$(98) \begin{array}{ccccccccc} lb. & oz. & dr. & sc. & grs. & & lb. & oz. & dr. scr. grs. \\ 94 & 11 & 1 & 1 & 13 & \div 9 = & 10 & 6 & 4 \ 1 \ 17 \end{array}$$

$$(99) \begin{array}{ccc} Cwt. & lb. & Cwt. qr. lb. \\ 312 & 21 & + 37 = 8 \ 1 \ 21 \text{ wt. of one hhd.} \end{array}$$

$$(100) \begin{array}{ccc} Cwt. & qr. & lb. \\ 1019 & 3 & 20 + 109 = 9 \ 1 \ 12 \text{ wt. of one hhd.} \end{array}$$

$$(101) \begin{array}{ccc} lb. & oz. & dwt. grs. \\ 18 & 1 & 12 \ 12 + 4 = 4 \ 6 \ 8 \ 3 \end{array}$$

DUODECIMALS.

*Answers.**

(1)

$$\begin{array}{r} F. \\ 6 \\ 3 \end{array} \begin{array}{r} I. \\ 6 \\ 2 \end{array}$$

$$\begin{array}{r} 19 & 6 \\ -1 & 1 \\ \hline 20 & 7 \end{array} \text{ Ans.}$$

(2)

$$\begin{array}{r} F. \\ 8 \\ 5 \end{array} \begin{array}{r} I. \\ 4 \\ 3 \end{array}$$

$$\begin{array}{r} 41 & 8 \\ -2 & 1 \\ \hline 43 & 9 \end{array} \text{ Ans.}$$

(3)

$$\begin{array}{r} 12 & 6 \\ -8 & 5 \end{array}$$

$$\begin{array}{r} 100 & 0 \\ -5 & 2 & 6 \\ \hline 105 & 2 & 6 \end{array}$$

(4)

$$\begin{array}{r} 26 & 4 \\ -12 & 7 \end{array}$$

$$\begin{array}{r} 316 & 0 \\ -15 & 4 & 4 \\ \hline 331 & 4 & 4 \end{array}$$

(5)

$$\begin{array}{r} 76 & 6 \\ -48 & 3 \end{array}$$

$$\begin{array}{r} 3672 & 0 \\ -19 & 1 & 6 \\ \hline 3691 & 1 & 6 \end{array}$$

(6)

$$\begin{array}{r} 45 & 6 \\ -38 & 7 \end{array}$$

$$\begin{array}{r} 1729 & 0 \\ -26 & 6 & 6 \\ \hline 1755 & 6 & 6 \end{array}$$

(7)

$$\begin{array}{r} 84 & 2 \\ -79 & 2 \end{array}$$

$$\begin{array}{r} 6649 & 2 \\ -14 & 0 & 4 \\ \hline 6663 & 2 & 4 \end{array}$$

(8)

$$\begin{array}{r} 126 & 6 \\ -121 & 3 \end{array}$$

$$\begin{array}{r} 15306 & 6 \\ -31 & 7 & 6 \\ \hline 15338 & 1 & 6 \end{array}$$

* These examples are all proved by Practice.

DUODECIMALS.

$$(9) \quad \begin{array}{r} F. \quad I. \\ \hline 764 & 5 \\ 192 & 4 \\ \hline 146768 & 0 \\ 254 & 9 \quad 8 \\ \hline 147022 & 9 \quad 8 \end{array}$$

$$(10) \quad \begin{array}{r} F. \quad I. \\ \hline 7681 & 8 \\ 1926 & 10 \\ \hline 14794890 & 0 \\ 6401 & 4 \quad 8 \\ \hline 14801291 & 4 \quad 8 \end{array}$$

$$(11) \quad \begin{array}{r} F. \quad I. \quad P. \\ \hline 7 & 3 & 3 \\ 1 & 7 & 6 \\ \hline 7 & 3 & 3 \\ 4 & 2 & 10 \quad 9 \\ 3 & 7 & 7 \quad 6 \\ \hline 11 & 9 & 9 \quad 4 \quad 6 \end{array}$$

$$(12) \quad \begin{array}{r} F. \quad I. \quad P. \\ \hline 8 & 6 & 6 \\ 7 & 3 & 4 \\ \hline 59 & 9 & 6 \\ 2 & 1 & 7 \quad 6 \\ 2 & 10 & 2 \\ \hline 62 & 1 & 11 \quad 8 \end{array}$$

$$(13) \quad \begin{array}{r} 4 \quad 10 \quad 6 \\ 2 \quad 4 \quad 8 \\ \hline 9 \quad 0 \quad 0 \\ 1 \quad 7 \quad 6 \\ 3 \quad 3 \\ \hline 11 \quad 7 \quad 9 \end{array}$$

$$(14) \quad \begin{array}{r} 7 \quad 8 \quad 6 \\ 7 \quad 2 \quad 8 \\ \hline 53 \quad 11 \quad 6 \\ 1 \quad 3 \quad 5 \quad 0 \\ 5 \quad 1 \quad 8 \\ \hline 55 \quad 8 \quad 0 \quad 8 \end{array}$$

$$(15) \quad \begin{array}{r} 3 \quad 6 \quad 3 \\ 2 \quad 4 \quad 6 \\ \hline 7 \quad 0 \quad 6 \\ 1 \quad 2 \quad 1 \quad 0 \\ 1 \quad 9 \quad 1 \quad 6 \\ \hline 8 \quad 4 \quad 4 \quad 1 \quad 6 \end{array}$$

$$(16) \quad \begin{array}{r} 12 \quad 2 \quad 10 \\ 9 \quad 6 \quad 4 \\ \hline 110 \quad 1 \quad 6 \\ 6 \quad 1 \quad 5 \quad 0 \\ 4 \quad 0 \quad 11 \quad 4 \\ \hline 116 \quad 6 \quad 11 \quad 11 \quad 4 \end{array}$$

DUODECIMALS.

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$$(17) \begin{array}{r} F. \quad I. \quad P. \\ 84 \quad 7 \quad 6 \\ 76 \quad 3 \quad 3 \\ \hline 6431 \quad 6 \quad 0 \\ 21 \quad 1 \quad 10 \quad 6 \\ 1 \quad 9 \quad 1 \quad 10 \quad 6 \\ \hline 6454 \quad 5 \quad 0 \quad 4 \quad 6 \end{array}$$

$$(18) \begin{array}{r} F. \quad I. \quad P. \\ 87 \quad 3 \quad 5 \\ 18 \quad 1 \quad 6 \\ \hline 1571 \quad 1 \quad 6 \\ 7 \quad 3 \quad 3 \quad 5 \\ 3 \quad 7 \quad 7 \quad 8 \quad 6 \\ \hline 1580 \quad 0 \quad 5 \quad 1 \quad 6 \end{array}$$

$$(19) \begin{array}{r} F. \quad I. \quad P. \\ 371 \quad 2 \quad 3 \\ 181 \quad 1 \quad 3 \\ \hline 67184 \quad 11 \quad 3 \\ 30 \quad 11 \quad 2 \quad 3 \\ 7 \quad 8 \quad 9 \quad 6 \quad 9 \\ \hline 67223 \quad 7 \quad 2 \quad 9 \quad 9 \end{array}$$

$$(20) \begin{array}{r} F. \quad I. \quad P. \\ 487 \quad 10 \quad 10 \\ 186 \quad 5 \quad 6 \\ \hline 90749 \quad 11 \quad 0 \\ 203 \quad 3 \quad 6 \quad 2 \\ 20 \quad 3 \quad 11 \quad 5 \quad 0 \\ \hline 90973 \quad 6 \quad 5 \quad 7 \quad 0 \end{array}$$

$$(21) \begin{array}{r} F. \quad I. \\ 18 \quad 6 \\ 1 \quad 2 \\ \hline 18 \quad 6 \\ 3 \quad 1 \quad 0 \\ \hline 21 \quad 7 \quad 0 \end{array}$$

$$(22) \begin{array}{r} F. \quad I. \\ 45 \quad 6 \\ 9 \quad 4 \\ \hline 409 \quad 6 \\ 15 \quad 2 \quad 0 \\ \hline 424 \quad 8 \quad 0 \end{array}$$

$$(23) \begin{array}{r} F. \quad I. \\ 64 \quad 6 \\ 47 \quad 8 \\ \hline 3031 \quad 6 \\ 43 \quad 0 \quad 0 \\ \hline 9)3074 \quad 6 \quad 0 \end{array}$$

Yards 341 5 6

$$(24) \begin{array}{r} F. \quad I. \\ 864 \quad 3 \\ 62 \quad 6 \\ \hline 53583 \quad 6 \\ 432 \quad 1 \quad 6 \\ \hline 9)54015 \quad 7 \quad 6 \end{array}$$

Yards 6001 6 7 6

26.

DUODECIMALS.

$$(25) \begin{array}{r} F. I. \\ 60 9 \\ - 22 3 \\ \hline 1336 6 \\ 15 2 3 \\ \hline 9) 1351 8 3 \end{array}$$

Yards 150 1 8 3

$$(27) \begin{array}{r} F. I. P \\ 3 8 9 \\ 1 4 6 \\ \hline 3 8 9 \\ 1 2 11 0 \\ 1 10 4 6 \\ \hline 5 1 6 4 6 \end{array}$$

$$(26) \begin{array}{r} F. I. \\ 40 6 \\ - 9 3 \\ \hline 364 6 \\ 10 1 6 \\ \hline 9) 374 7 6 \end{array}$$

Yards 41 5 7 6

$$\begin{array}{r} F. I. P \\ 3 7 9 \\ 1 5 1 \\ \hline 3 7 9 \\ 1 6 2 9 \\ 3 7 9 \\ \hline 5 2 3 4 9 \\ 3 \times 5 = 15 \end{array}$$

15 6 10 2 3
5

F. 77 10 2 11 3

$$(29) \begin{array}{r} F. I. \\ 1 6 \\ 1 3 \\ \hline 1 6 \\ 4 6 \\ \hline 1 10 6 \\ 16 3 \text{ long} \\ \hline 30 0 0 \\ 5 7 6 \\ \hline F. 30 5 7 6 \end{array}$$

$$(30) \begin{array}{r} F. I. P \\ 1 5 6 \\ 1 2 10 \\ \hline 1 5 6 \\ 2 11 0 \\ 1 2 7 0 \\ \hline 1 9 7 7 0 \\ 12 3 7 \text{ long} \\ \hline 21 7 7 0 0 \\ 5 4 10 9 0 \\ 1 0 7 5 1 0 \\ \hline F. 22 2 0 6 2 1 0 \end{array}$$

REDUCTION.

27

REDUCTION.

Answers.

$$\begin{array}{r}
 \text{(1)} \quad \begin{array}{r} \frac{5}{20} \\ - 12 \\ \hline 240 \end{array} \text{ pence.} \\
 \qquad \qquad \qquad \frac{4}{\hline} \\
 \qquad \qquad \qquad 960 \text{ farthings.}
 \end{array}$$

$$\begin{array}{r}
 \text{(2)} \qquad \qquad \qquad \text{4) } 960 \\
 \hline
 12) 240 \\
 \hline
 \end{array}$$

(3)	<u>£</u>
	36
	20
	<u>—</u>
	720
	12
	<u>—</u>
	8640
	4
	<u>—</u>
	34560

$$\begin{array}{r}
 \text{grs.} \\
 (4) \quad 4\overline{)34560} \\
 -12) \quad 8640 \\
 -20) \quad 7210 \\
 \hline
 \text{£ } 36
 \end{array}$$

- (5) 346*l.* 6*s.* 8*½d.* = 332481 farthings.
(6) 332481 farthings = 346*l.* 6*s.* 8*½d.*
(7) 86 guineas \times 1008 = 86688 farthings.
(8) 86688 \div 1008 = 86 guineas.
(9) 384*l.* \times 60 = 23040 fourpences.
(10) 23040 groats \div 60 = 384 pounds.
(11) 682 moidores = 883872 farthings,
(12) 883872 farthings = 682 moidores.
(13) 1000*l.* = 4000 crowns, 8000 half-crowns, 24000 pence.
(14) 24000 pence = 4000 crowns, 8000 half crowns, 1000 pounds.

REDUCTION

- (15) $234l.=936$ crowns, 4680 shillings, 14040 groats,
56160 pence.
- (16) 56160 pence = 14040 groats, 4680 shillings, 936
crowns, 234 pounds.
- (17) $152l.=3040$ shillings, 608 crowns.
- (18) 608 crowns = 3040 shillings, 152 pounds.
- (19) First, $695l. 8s.=166896$ pence, and $4s. 9d.=57$
pence; then $166896 \div 57=2928$ ducats.
- (20) First, $4s. 9d.=57$ pence; then $2928 \times 57=166896$
pence. = $695l. 8s.$
- (21) First, $4321l. 18s. 9d.=2074410$ halfpence; and $13\frac{1}{2}d.$
= 27 halfpence; then $2074410 + 27 = 76830$ pieces.
- (22) First, $13\frac{1}{2}d.=27$ halfpence; then $76830 \times 27 =$
 2074410 halfpence = $4321l. 18s. 9d.$
- (23) Here $16 \times 36 \times 4 = 2304$ quarter guineas.
- (24) $2304 \div 4 + 36 = 16$ ingots.
- (25) First, $993l. 4s. 6d.=238374$ pence, and $4s. 3d.=51$
pence; then $238374 \div 51 = 4674$ dollars.
- (26) First, $4s. 3d.=51$ pence; then $4674 \times 51 = 238374$
pence = $993l. 4s. 6d.$
- (27) First, $357l. 11s. 10\frac{1}{2}d.=343290$ farthings; then
 $343290 \times 360 = 123584400$ farthings.
- (28) First, $357l. 11s. 10\frac{1}{2}d.=343290$ farthings; then
 $123584400 + 343290 = 360$ talents.
- (29) First, $5s. + 2s. 6d. + 1s. = 8s. 6d.=102$ pence; and
 $426l. 14s.=102408$ pence; then $102408 \div 102 =$
1004 of each.

$$(30) \text{Here, } 1004 \div \left\{ \begin{array}{rcl} 4 & = & 251 & 0 \\ 8 & = & 125 & 10 \\ 20 & = & 50 & 4 \end{array} \right.$$

426 14 Answer

- (31) First, $13\frac{1}{2}d. + 12d. + 9d. + 6d. + 4d. + 2d. = 46\frac{1}{2}d.=93$
halfpence, and $58l. 2s. 6d.=27900$ halfpence;
then $27900 + 93 = 300$ pieces.

- (32) First, $13\frac{1}{2}d. + 12d. + 9d. + 6d. + 4d. + 2d. = 46\frac{1}{2}d. = 93$ halfpence ; then $300 \times 93 = 27900$ halfpence $= 58l. 2s. 6d.$
- (33) First, $4s. 3d. = 51$ pence ; then $1120 \times 51 = 57120$ pence $= 238l.$
- (34) First, $238l. = 57120$ pence, and $4s. 3d. = 51$ pence ; then $57120 + 51 = 1120$ dollars.
-
- (35) Here, $560 \times 17 + 20 = 476l.$
- (36) Here, $476 \times 20 + 17 = 560$ pistoles.
- (37) First, $5s. 3d. = 63$ pence, or one quarter guinea ; then $800 \times 63 = 50400$ pence $= 210l.$
- (38) First, $5s. 3d. = 63$ pence, and $210l. = 50400$ pence ; then $50400 + 63 = 800$ quarter guineas.
- (39) First, $6s. 8d. = 80$ pence ; then $896 \times 80 = 71680$ pence $= 298l. 13s. 4d.$
- (40) First, $298l. 13s. 4d. = 71680$ pence, and $6s. 8d. = 80$ pence ; then $71680 + 80 = 896$ nobles.
- (41) Here, $225 \times 21 + 27 = 175$ moidores.
- (42) Here, $175 \times 27 + 21 = 225$ guineas.
- (43) Here, $170 \times 17 + 5 = 578$ crowns.
- (44) Here, $578 \times 5 + 17 = 170$ pistoles.
- (45) First, $5s. 6\frac{1}{2}d. = 133$ halfpence, and $4s. 7d. = 110$ halfpence ; then $14630 \times 110 + 133 = 12100$ ducatoons.
- (46) First, $4s. 7d. = 110$ halfpence, and $5s. 6\frac{1}{2}d. = 133$ halfpence ; then $12100 \times 133 + 110 = 14630$ cobs.
- (47) First, $6s. 8\frac{1}{2}d. = 161$ halfpence, and $7s. 6d. = 180$ halfpence ; then $644 \times 180 + 161 = 720$ milreas.
- (48) First, $7s. 6d. = 180$ halfpence, and $6s. 8\frac{1}{2}d. = 161$ halfpence ; then $720 \times 161 + 180 = 644$ Romish crowns.
- (49) First, $1l. 1s. 8d. = 260$ pence, and $1l. = 240$ pence ; then $1500 \times 260 + 240 = 1625l.$ Irish.
- (50) Here, $1625 \times 240 + 260 = 1500$ English.
- (51) $28lb. \times 480 = 132480$ grains.

REDUCTION.

- (52) $132480 \text{ grs.} \div 480 = 23 \text{ pounds.}$
- (53) $18 \text{ lb. } 6 \text{ oz. } 8 \text{ dwt. } 4 \text{ gr.} = 106756 \text{ grains}$
- (54) $106756 \text{ gr.} = 18 \text{ lb. } 6 \text{ oz. } 8 \text{ dwt. } 4 \text{ gr.}$
- (55) First, $3 \text{ lb. } 4 \text{ oz. } 2 \text{ dwt. } 9 \text{ gr.} = 19257 \text{ grains; then}$
 $19257 \times 8 = 154056 \text{ grains.}$
- (56) First, $3 \text{ lb. } 4 \text{ oz. } 2 \text{ dwt. } 9 \text{ gr.} = 19257 \text{ grains; then}$
 $154056 + 19257 = 8 \text{ ingots.}$
- (57) First, $55 \text{ oz. } 9 \text{ dwt. } 14 \text{ gr.} = 26680 \text{ grains, and}$
 $41 \text{ lb. } 7 \text{ oz. } 6 \text{ dwt. } 6 \text{ gr.} = 239670 \text{ grains; then}$
 $239670 + 26680 = 9 \text{ tankards.}$
- (58) Here, $55 \text{ oz. } 9 \text{ dwt. } 14 \text{ gr.} \times 9 = 41 \text{ lb. } 7 \text{ oz. } 6 \text{ dwt.}$
 6 grains.
- (59) $24 \times 12 \times 8 \times 3 \times 20 = 138240 \text{ grains.}$
- (60) $138240 + 5760 = 24 \text{ pounds.}$
- (61) $421 \text{ lb. } 6 \text{ oz. } 3 \text{ dr. } 2 \text{ sc. } 9 \text{ gr.} = 2428069 \text{ grains.}$
- (62) $2428069 \text{ gr.} = 421 \text{ lb. } 6 \text{ oz. } 3 \text{ dr. } 2 \text{ sc. } 9 \text{ grains.}$
- (63) First, $12 \text{ lb. } 6 \text{ oz.} = 3600 \text{ scruples; then}$
 $3600 \div 4 = 900 \text{ boluses; and}$
 $900 \div 45 = 20 \text{ boluses to each patient.}$
- (64) $45 \times 20 \times 4 = 3600 \text{ sc.} = 12 \text{ lb. } 6 \text{ oz.}$
- (65) $16 \times 20 \times 112 \times 16 \times 16 = 9175040 \text{ drachms.}$
- (66) $9175040 + 16 + 16 + 112 + 20 = 16 \text{ tons.}$
- (67) $146 \text{ ton. } 12 \text{ cwt. } 2 \text{ qr. } 8 \text{ lb. } 4 \text{ oz. } 6 \text{ dr.} = 84082758 \text{ drachms.}$
- (68) $84082758 \text{ drs.} = 146 \text{ ton. } 12 \text{ cwt. } 2 \text{ qr. } 8 \text{ lb. } 4 \text{ oz. } 6 \text{ drachms.}$
- (69) First, $7 \text{ cwt. } 2 \text{ qr. } 21 \text{ lb.} = 861 \text{ pounds; then}$
 $861 \times 7 = 6027 \text{ pounds.}$
- (70) First, $7 \text{ cwt. } 2 \text{ qr. } 21 \text{ lb.} = 861 \text{ pounds; then}$
 $6027 + 861 = 7 \text{ hogsheads.}$
- (71) First, $41 \text{ cwt. } 1 \text{ qr. } 18 \text{ lb. } 2 \text{ oz.} = 74210 \text{ ounces, and}$
 $12 \text{ lb. } 13 \text{ oz.} = 205 \text{ ounces; then}$
 $74210 + 205 = 362 \text{ parcels.}$
- (72) First, $12 \text{ lb. } 13 \text{ oz.} = 205 \text{ ounces; then}$
 $362 \times 205 = 74210 \text{ ounces} = 41 \text{ cwt. } 1 \text{ qr. } 18 \text{ lb. } 2 \text{ ounces.}$

REDUCTION.

31

- (73) First, $4+6+10+12=32$ pounds, and 4 cwt. 2 qr.
 8 lb. $\times 4=512 \times 4=2048$ pounds; then $2048+32=64$ parcels.
- (74) First, $4+6+10+12 \times 64=32 \times 64=2048$ pounds;
then $2048+112=4$ cwt. 2 qr. 8 lb. weight of one
hogshead.
- (75) $342 \times 16=5472$ nails.
- (76) $5472+16=342$ yards.
- (77) 62 yd. 2 qr. 1 na. = 1001 nails.
- (78) $1001+4+4=62$ yd. 2 qr. 1 nail.
- (79) 40 E. ells. 3 qr. 2 na. = 814 nails.
- (80) $814+4+5=40$ E. ells. 3 qr. 2 na. = 814 nails.
- (81) 84 Fl. ells. 2 qr. 3 na. = 1019 nails.
- (82) 1019 na. + $4+3=84$ Fl. ells. 2 qr. 8 nails.
- (83) $36 \times 52 \times 16=29952$ nails.
- (84) First $52 \times 16=832$ nails; then $29952+832=36$
pieces.
- (85) $90 \times 3\frac{1}{2}=292\frac{1}{2}$ yards.
- (86) $292\frac{1}{2}+90=3\frac{1}{4}$ yards for each boy.
- (87) 1 lea. $\times 3 \times 8 \times 40=3$ miles, 24 furlongs, 960 poles.
- (88) $960+40+8+5=1$ league.
- (89) 48 miles = 384 furlongs, 15360 poles, 84480 yards,
 253440 feet, 3041280 inches, 9123840 barley corns.
- (90) 9123840 b. c. = 48 miles.
- (91) First $25 \times 1760 \times 6=264000$ half feet, and $16\frac{1}{2} \times 2=33$ half feet; then $264000+33=8000$ turns.
- (92) $8000 \times 16\frac{1}{2}=132000$ feet = 25 miles.
- (93) 25020×1056 (paces in one mile) = 26421120 paces,
and $26421120 \times 5 \times 12 \times 3 = 132105600$ feet,
 1585267200 inches, 4755801600 barley corns.
- (94) $4755801600+190080=25020$ miles.
- (95) $984 \times 4 \times 40=77440$ poles.
- (96) $77440+180=484$ acres.
- (97) 4321 acres, 3 roods, 34 poles = 691514 poles.

REDUCTION.

- (98) $691514 + 40 + 4 = 4321$ acres, 3 roods, 34 poles.
- (99) $4140 \times 160 = 662400$ perches; then $662400 + 360 = 1840$ shares.
- (100) $1840 \times 360 = 662400$ perches; then $662400 + 160 = 4140$ acres.
- (101) $46 \times 63 \times 8 = 23184$ pints.
- (102) $23184 \div 504 = 46$ hogsheads.
- (103) 46 tons, 3 hhds. 45 gall. 3 qts. 1 pt. = 94615 pints.
- (104) $94615 + 8 + 63 + 4 = 46$ tons. 3 hhd. 45 gall. 3 qr. 1 pint.
- (105) First, $15 \text{ hhds.} \times 63 \times 8 = 7560$ pts., and 12 qts.
 $12 \text{ pts.} = 36$ pts.; then $7560 + 36 = 210$ dozen of each.
- (106) $210 \text{ doz.} \times 36 \text{ pts.} + 504 = 7560 + 504 = 15$ hhds.
- (107) $21 \times 48 \times 8 = 8064$ pints.
- (108) $8064 \div 8 + 48 = 21$ hogsheads.
- (109) $30 \times 54 \times 8 = 12960$ pints.
- (110) $12960 \div 8 + 54 = 30$ hogheads.
- (111) $363 \times 1\frac{1}{2} \times 54 \times 8 = 242$ hhds. 13068 gall. 104544 pints.
- (112) $104544 \div 8 + 54 + 1\frac{1}{2} = 363$ barrels.
- (113) First 6 bts. 1 hhd. 40 gall. 2 qts. = 2970 quarts;
 and $54 + 36 + 9 = 99$ gall. = 396 quarts; then
 $2970 + 396 = 7$ of each sort, and 198 quarts over.
- (114) First $54 + 36 + 9 \times 4 = 396$ qts.; 7 hhd. 7 bar. 7 fir.
 198 qts. = 2970 quarts; then $2970 \times 396 = 1166120$ qts. = 6 buts. 1 hhd. 40 gall. 2 quarts.
- (115) $304 \times 8 \times 8 = 19456$ gallons.
- (116) $19456 \div 64 = 304$ quarters.
- (117) $4 \times 10 \times 8 \times 8 \times 8 = 20480$ pints.
- (118) $20480 \div 8 + 8 + 8 + 10 = 4$ lasts.
- (119) 2 lasts. 1 w. 3 q. 2 b. 3 p. 1 g. = 1815 gallons.
- (120) 1815 gallons. = 2 l. 1 w. 3 q. 2 b. 3 p. 1 g.

THE RULE OF THREE DIRECT. 33

- (121) $124 \times 36 \times 4 = 17856$ pecks.
 - (122) $17856 \div 4 \div 36 = 124$ chaldrōns.
 - (123) $421 \text{ ch. } 12 \text{ bus.} = 15168 \text{ bus.}$; and $15168 \div 3 = 5056$ sacks.
 - (124) $5056 \times 3 \div 36 = 421$ ch. 12 bus.
 - (125) A solar year = 365 days 5 hr. 48 min. 55 sec. = 31556935 sec.
 - (126) 31556935 sec. = 365 days 5 hrs. 48 min. 55 sec.
 - (127) First $4004 + 1785 = 5792$ years since the creation; then $31556935 \times 5792 = 182777767520$ seconds.
 - (128) $182777767520 \div 31556935 = 5792$ solar years.
 - (129) $12 \times 360 \times 60 \times 60 = 15552000$ seconds.
 - (130) $15552000 \div 60 \div 60 \div 360 = 12$ revolutions.
 - (131) 41 rev. 6 signs 4 deg. 30 min. 45 sec. = 53800245 seconds.
 - (132) 53800245 sec. = 41 rev. 6 signs 4 deg. 30 min. 45 sec.
 - (133) $1 \times 9 \times 144 = 1296$ square inches.
 - (134) $1296 \div 144 \div 9 = 1$ square yard.
 - (135) $864 \text{ ft. } 3 \text{ in.} \times 62 \text{ ft. } 6 \text{ in.} \div 9 = 6001 \text{ yds. } 6 \text{ ft. } 7 \text{ in.}$
6 parts.
 - (136) 1 sq. mile = 640 acres, 2560 roods, 102400 poles,
3097600 yards, 27878400 feet, 4014489600 inches.
 - (137) 4014489600 inches = 1 square mile.
 - (138) 1 solid yard = 27 feet, 46656 solid inches.
 - (139) 46656 solid inches = 1 solid yard.
 - (140) $16 \text{ ft. } 3 \text{ in.} \times 18 \text{ in.} \times 15 \text{ in.} = 30 \text{ ft. } 5 \text{ in. } 7 \text{ pts. } 5 \text{ sec.}$
-

THE RULE OF THREE DIRECT.

Ex. (1) is worked.

$$(1) \quad 2l \text{ 14s.} \quad :: \quad 9 \text{ yds.} \quad :: \quad 18s. \quad :: \quad 3 \text{ yds.}$$

$$(2) \quad 4 \text{ yds.} \quad :: \quad 2l. \quad :: \quad :: \quad 14 \text{ yds.} \quad :: \quad 7l.$$

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- (4) $7l. : 14 \text{ yds.} :: 2l. : 4 \text{ yds.}$
- (5) $9 \text{ yds.} : 3l. :: 36 \text{ yds.} : 12l.$
- (6) $12l. : 36 \text{ yds.} :: 3l. : 9 \text{ yds.}$
- (7) $3 \text{ yds.} : 2l. 9s. :: 24 \text{ yds.} : 19l. 12s.$
- (8) $19l. 12s. : 24 \text{ yds.} :: 2l. 9s. : 3 \text{ yds.}$
- (9) $4 \text{ yds.} : 1l. 9s. :: 48 \text{ yds.} : 17l. 8s.$
- (10) $17l. 8s. : 48 \text{ yds.} :: 1l. 9s. : 4 \text{ yds.}$
- (11) $7 \text{ yds.} : 3l. 6s. 6d. :: 36 \text{ yds.} : 17l. 2s.$
- (12) $17l. 2s. : 36 \text{ yds.} :: 3l. 6s. 6d. : 7 \text{ yds.}$
- (13) $8 \text{ yds.} : 18s. 8d. :: 54 \text{ yds.} : 6l. 6s.$
- (14) $6l. 6s. : 54 \text{ yds.} :: 18s. 8d. : 8 \text{ yds.}$
- (15) $9 \text{ ft.} : 15s. 9d. :: 72 \text{ ft.} : 6l. 6s.$
- (16) $6l. 6s. : 72 \text{ ft.} :: 15s. 9d. : 9 \text{ ft.}$
- (17) $10 \text{ lb.} : 1l. 2s. 1d. :: 81 \text{ lb.} : 8l. 18s. 10\frac{1}{2}d.$
- (18) $8l. 18s. 10\frac{1}{2}d. : 81 \text{ lb.} :: 1l. 2s. 1d. : 10 \text{ lb.}$
- (19) $12 \text{ qrs.} : 14l. 11s. :: 90 \text{ qrs.} : 109l. 2s. 6d.$
- (20) $109l. 2s. 6d. : 90 \text{ qrs.} :: 14l. 11s. : 12 \text{ qrs.}$
- (21) $14 \text{ lb.} : 12l. 5s. :: 99 \text{ lb.} : 86l. 12s. 6d.$
- (22) $86l. 12s. 6d. : 99 \text{ lb.} :: 12l. 5s. : 14 \text{ lb.}$
- (23) $15 \text{ lb.} : 5l. 18s. 1\frac{1}{2}d. :: 108 \text{ lb.} : 42l. 10s. 6d.$
- (24) $42l. 10s. 6d. : 108 \text{ lb.} :: 5l. 18s. 1\frac{1}{2}d. : 15 \text{ lb.}$
- (25) $18 \text{ yds.} : 17l. 19s. 7\frac{1}{2}d. :: 48 \text{ yds.} : 47l. 19s.$
- (26) $47l. 19s. : 48 \text{ yds.} :: 17l. 19s. 7\frac{1}{2}d. : 18 \text{ yds.}$
- (27) $21 \text{ ells} : 5l. 18s. 1\frac{1}{2}d. :: 72 \text{ ells} : 20l. 5s.$
- (28) $20l. 5s. : 72 \text{ ells} :: 5l. 18s. 1\frac{1}{2}d. : 21 \text{ ells.}$
- (29) $27 \text{ pair} : 8l. 0s. 10\frac{1}{2}d. :: 81 \text{ pair} : 24l. 2s. 7\frac{1}{2}d.$
- (30) $24l. 2s. 7\frac{1}{2}d. : 81 \text{ pair} :: 8l. 0s. 10\frac{1}{2}d. : 27 \text{ pair.}$
- (31) $45 \text{ doz.} : 73l. 2s. 6d. :: 120 \text{ doz.} : 195l.$
- (32) $195l. : 120 \text{ doz.} :: 73l. 2s. 6d. : 45 \text{ doz.}$
- (33) $56 \text{ qrs.} : 63l. :: 144 \text{ qrs.} : 162l.$

THE RULE OF THREE DIRECT. 35

- (34) 162 ℓ . : 144 qrs. :: 69 ℓ . : 56 qrs.
- (35) 72 gall. : 6 ℓ . :: 25 hhds; or 8100 gall.
112 ℓ . 10s.
- (36) 112 ℓ . 10s. : 25 hhds. :: 6 ℓ . : 72 gall.
- (37) 77 gross : 12 ℓ . 5s. 3 $\frac{1}{2}$ d. :: 144 gross : 22 ℓ . 19s.
- (38) 22 ℓ . 19s. : 144 gross :: 12 ℓ . 5s. 3 $\frac{1}{2}$ d. : 77
gross.
- (39) 6 ℓ . : 81 lb. :: 15 ℓ . 10s. : 209 $\frac{1}{2}$ lb.
- (40) 209 $\frac{1}{2}$ lb. : 15 ℓ . 10s. :: 81 lb. : 6 ℓ .
- (41) 70 yds. : 78 ℓ . 15s. :: 38 ℓ . 5s. : 34 yds.
- (42) 34 yds. : 38 ℓ . 5s. :: 70 yds. : 78 ℓ . 15s.
- (43) 7 $\frac{1}{2}$ yds. : 17s. 6d. :: 515 yds. : 60 ℓ . 1s. 8d.
- (44) 60 ℓ . 1s. 8d. : 515 yds. :: 17s. 6d. : 7 $\frac{1}{2}$ yds.
- (45) 3 oz. 10 dwts. : 1 ℓ . 1s. 10 $\frac{1}{2}$ d. :: 655 oz. 4
dwt. 16 grs. : 204 ℓ . 15s. 2 $\frac{1}{2}$ d.
- (46) 204 ℓ . 15s. 2 $\frac{1}{2}$ d. : 655 oz. 4 dwt. 16 grs. :: 1 ℓ .
1s. 10 $\frac{1}{2}$ d. : 3 oz. 10 dwt.
- (47) 2 hhd. 19 $\frac{1}{2}$ gall. : 99 ℓ . 1s. 2 $\frac{1}{2}$ d. :: 12 pipes
1 hhd. 36 gall. : 1030 ℓ . 7s. 4 $\frac{1}{2}$ d.
- (48) 1030 ℓ . 7s. 4 $\frac{1}{2}$ d. : 12 pipes 1 hhd. 36 gall. ::
93 ℓ . 1s. 2 $\frac{1}{2}$ d. : 2 hhd. 19 $\frac{1}{2}$ gall.
- (49) First 5 cwt. 2 qr. 18 lb. \times 10 = 56 cwt. 2 qr. 12 lb.
whole weight; then 16 $\frac{1}{2}$ lb. : 8s. 1 $\frac{1}{4}$ d. ::
56 cwt. 2 qr. 12 lb. : 171 ℓ . 14s. 2d.
- (50) 171 ℓ . 14s. 2d. : 56 cwt. 2 qr. 12 lb. :: 8s.
11 $\frac{1}{2}$ d. : 16 $\frac{1}{2}$ lb.
- (51) First, 8 cwt. 1 qr. 12 lb. \times 9 = 75 cwt. 24 lb.; then
1 cwt. 3 qr. 19 lb. 4 oz. : 15 ℓ . 10s. :: 75
cwt. 24 lb. : 624 ℓ .
- (52) 624 ℓ . : 75 cwt. 24 lb. :: 15 ℓ . 10s. : 1 cwt.
3 qr. 19 lb. 4 oz.
- (53) First, 8 cwt. 3 qr. 6 lb. 4 oz. \times 5 = 44 cwt. 3 lb. 4
oz.; then, 4 cwt. 2 qr. 6 lb. 8 oz. : 24 ℓ . 16s.
8 $\frac{1}{2}$ d. :: 44 cwt. 3 lb. 4 oz. : 239 ℓ . 17s. 9 $\frac{1}{2}$
4 $\frac{1}{2}$ d.

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- (54) $239l. 17s. 9\frac{5}{8}d. :: 44 \text{ cwt. } 3 \text{ lb. } 4 \text{ oz.} ::$
 $24l. 16s. 8\frac{1}{4}d. :: 8168 \text{ oz.}$
- (55) $252 \text{ gall.} :: 50l. 8s. 6\frac{1}{4}d. :: 12 \text{ tons } 3 \text{ hhds.}$
 $46 \text{ gall.} :: 652l. 3s. 3\frac{4}{5}d. ::$
- (56) $652l. 3s. 3\frac{4}{5}d. :: 12 \text{ tons } 3 \text{ hhd. } 46 \text{ gall.} ::$
 $50l. 8s. 6\frac{1}{4}d. :: 252 \text{ gall.}$
- (57) $69l. 18s. 7d. :: 1 \text{ cwt. } 1 \text{ qr. } 7 \text{ lb. } 4 \text{ oz.} :: 560l.$
 $10s. 4\frac{1}{4}d. :: 10 \text{ cwt. } 2 \text{ qr. } 4 \text{ lb. } 4\frac{3}{8}\frac{8}{13}\frac{4}{2} \text{ oz.}$
- (58) $10 \text{ cwt. } 2 \text{ qr. } 4 \text{ lb. } 4 \text{ oz. } 3\frac{4}{5}\frac{1}{2} :: 560l. 10s. 4\frac{1}{4}d.$
 $:: 1 \text{ cwt. } 1 \text{ qr. } 7 \text{ lb. } 4 \text{ oz.} :: 69l. 18s. 7d.$
- (59) First, $24 \times 24 \times 40 \times 120 = 2764800 \text{ yds. in all; then}$
 $24 \text{ yds.} :: 8l. 17s. 6\frac{1}{4}d. :: 2764800 \text{ yds.} ::$
 $1022760l.$
- (60) $1022760l. :: 2764800 \text{ yds.} :: 8l. 17s. 6\frac{1}{4}d. ::$
 24 yds.
- (61) $43 \text{ lb. } 6 \text{ oz. } 3 \text{ drs.} :: 2l. 5s. 1\frac{1}{4}d. :: 4 \text{ tons } 6 \text{ cwt.}$
 $2 \text{ qr. } 4 \text{ lb. } 6 \text{ oz.} :: 503l. 16s. 0\frac{1}{2}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}d.$
- (62) $503l. 16s. 0\frac{1}{2}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}d. :: 4 \text{ tons } 6 \text{ cwt. } 2 \text{ qr. } 4 \text{ lb.}$
 $6 \text{ oz.} :: 2l. 5s. 1\frac{1}{4}d. :: 11107 \text{ drs.}$
- (63) First, $240l. 2s. + 42l. (\text{gain}) = 282l.$ 2s. the cloves
 must be sold for; then $16 \text{ cwt. } 2 \text{ qr. } 14 \text{ lb.} ::$
 $282l. 2s. :: 1 \text{ lb.} :: 3s. 0\frac{1}{4}\frac{8}{18}\frac{6}{6}\frac{1}{2}d.$
- (64) $3s. 0\frac{1}{4}\frac{8}{18}\frac{6}{6}\frac{1}{2}d. :: 1 \text{ lb.} :: 282l. 2s. :: 1862 \text{ lb.}$
 $= 16 \text{ cwt. } 2 \text{ qr. } 14 \text{ lb.}$
- (65) First, $482l.$ cost,
 173 charges,
 260 gain.

915 the whole is to be sold for :

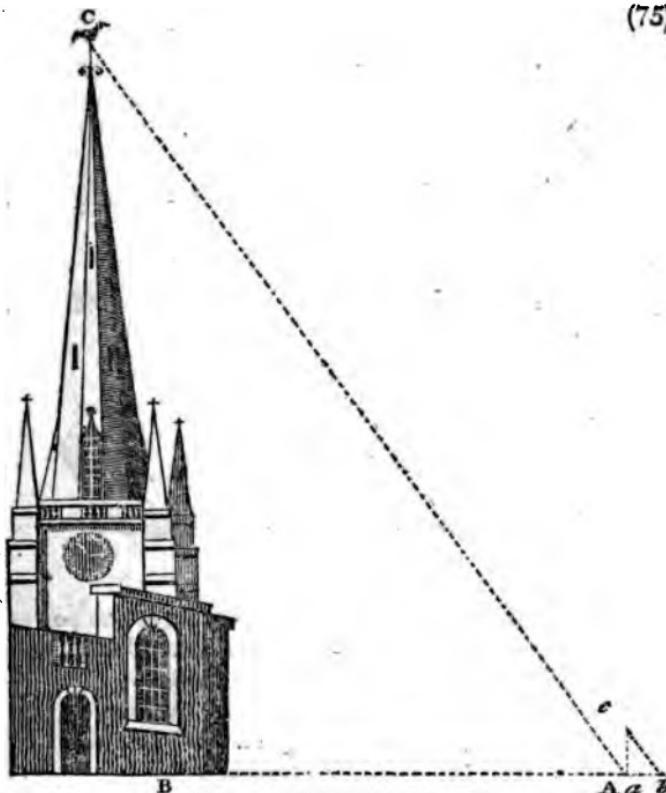
- then $72 \text{ tons} :: 915l. :: 12 \text{ tons} :: 152l. 10s.$
- (66) $152l. 10s. :: 12 \text{ tons} :: 915l. :: 72 \text{ tons.}$
- (67) First, $180l. - 15l. = 165l.$ the whole must be sold for;
 then, $400 \text{ yds.} :: 165l. :: 1 \text{ yd.} :: 8s. 3d.$
- (68) $8s. 3d. :: 1 \text{ yd.} :: 165l. :: 400 \text{ yds.}$
- (69) First, $552 \times 85\frac{1}{2} = 47196 \text{ yds.};$ then, $57 \text{ yds.} ::$
 $47196 \text{ yds.} :: 41 \text{ yds.} :: 33948 \text{ yds.}$

THE RULE OF THREE DIRECT.

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- (70) First, $552 \times 85\frac{1}{2} = 47196$ yds.; then 39948 yds. ::
 41 yds. :: 47196 yds. :: 57 yds.
- (71) First, 3s. 4d. :: 1 ell. :: 443l. 6s. 8d. :: 2660
 ells; then, $2660 \div 28 = 95$ pieces.
- (72) First, $95 \times 28 = 2660$ ells; then, 2660 ells :: 443l.
 6s. 8d. :: 1 ell. :: 3s. 4d.
- (73) First, 1 ell = $1\frac{1}{4}$ yard; then, 9s. 6 $\frac{1}{4}$ d. :: $1\frac{1}{4}$ yd. ::
 20l. 16s. 4 $\frac{1}{2}$ d. :: 54 yds. 1 qr. $2\frac{1}{4}\frac{1}{2}$ na.
- (74) 54 yds. 1 qr. $2\frac{1}{4}\frac{1}{2}$ na. :: 20l. 16s. 4 $\frac{1}{2}$ d. :: 1
 ell :: 9s. 6 $\frac{1}{4}$ d.

(75)

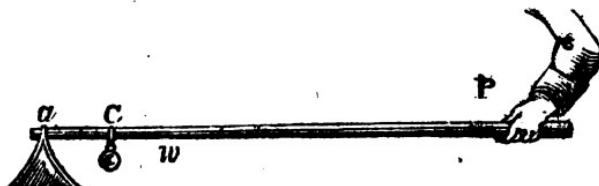


In the above figure $a c = 3$ feet 2 inches the length of the cane; $a b = 6$ feet 3 inches length of its shadow. Also $B C =$ the height of the steeple, and $A B = 144$ yards 2 feet 2 inches the length of its shadow.

38 THE RULE OF THREE DIRECT.

- (75) 6 ft. 3 in. : 3 ft. 2 in. :: 144 yds. 2 ft. 2 in.
 : 73 yds. 11 $\frac{4}{5}$ in.
- (76) 73 yds. 11 $\frac{4}{5}$ in. :: 144 yds. 2 ft. 2 in. :: 3 ft.
 2 in. : 6 ft. 3 in.
- (77) 1 sec. : 1142 ft. :: 8 $\frac{1}{2}$ sec. : 9707 ft.
- (78) 9707 ft. : 8 $\frac{1}{2}$ sec. :: 1142 ft. : 1 sec.
- (79) 1 sec. : 1142 ft. :: 5 sec. : 5710 ft. = 1 mile
 430 ft.
- (80) 5710 ft. : 5 sec. :: 1142 ft. : 1 sec.
- (81) 100*l.* : 4*l.* 10*s.* :: 96*l.* 4*s.* : 4*l.* 6*s.* 6 $\frac{1}{4}$ $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ *d.*
- (82) 4*l.* 6*s.* 6 $\frac{1}{4}$ $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ *d.* : 96*l.* 4*s.* :: 4*l.* 10*s.* : 100*l.*
- (83) First, 100*l.* + 4*l.* 10*s.* = 104*l.* 10*s.* amount of 100*l.*
 for one year; then, 104*l.* 10*s.* : 4*l.* 10*s.* ::
 146*l.* 10*s.* : 6*l.* 6*s.* 2 $\frac{1}{2} \frac{1}{2} \frac{1}{2}$ *d.*
- (84) 6*l.* 6*s.* 2 $\frac{1}{2} \frac{1}{2} \frac{1}{2}$ *d.* : 146*l.* 10*s.* :: 4*l.* 10*s.* :
 104*l.* 10*s.*
- (85) 25262*l.* 12*s.* 4 $\frac{1}{2}$ *d.* : 12631*l.* 6*s.* 2 $\frac{1}{2}$ *d.* :: 1*l.** : 10*s.*
- (86) 10*s.* : 1*l.* :: 12631*l.* 6*s.* 2 $\frac{1}{2}$ *d.* : 25262*l.*
 12*s.* 4 $\frac{1}{2}$ *d.*

(87)



Levers of the second order are such as have the power at one end P, the prop fixed directly at the other a, and weight w, somewhere between them, as at C.

First, 140 in.—12 $\frac{1}{2}$ in.=127 $\frac{1}{2}$ in.=C b, the longest end of the lever; then, 12 $\frac{1}{2}$ in. : 186 lb. :: 127 $\frac{1}{2}$ in. : 1897 $\frac{1}{2}$ lb.

- (88) 1897 $\frac{1}{2}$ lb. : 127 $\frac{1}{2}$ in. :: 186 lb. : 12 $\frac{1}{2}$ in.

* 1*l.* is the 3rd term in the stating, and 10*s.* the fourth.

$$(89) \begin{matrix} \text{3 eggs : 1d. :: 864 eggs : } \\ \text{2 6 4 both sorts sold for.} \end{matrix} \quad \begin{matrix} \text{£ s. d.} \\ \left\{ \begin{array}{l} \text{value of the eggs at} \\ \text{3 a-penny.} \end{array} \right. \\ \hline \end{matrix}$$

$$\text{diff. 1 2 4 } \quad \left\{ \begin{array}{l} \text{value of the eggs} \\ \text{at 2 a penny.} \end{array} \right.$$

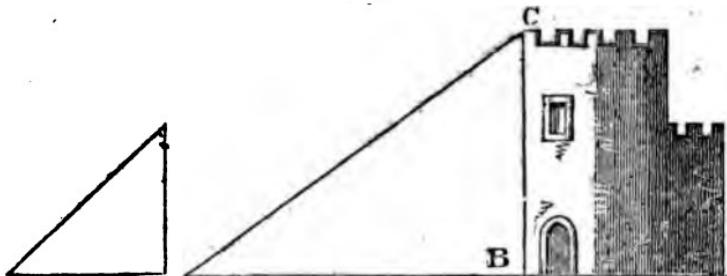
then, 1l. 2s. 4d. \times 2 = 268d. \times 2 = 536 eggs at 2 a-penny.

$$(90) \begin{matrix} \text{First, 2 eggs : 1d. :: 536 eggs : } \\ \text{2 6 4 value of the whole.} \end{matrix} \quad \begin{matrix} \text{£ s. d.} \\ \left\{ \begin{array}{l} \text{value of the eggs} \\ \text{at 2 a-penny.} \end{array} \right. \\ \hline \end{matrix}$$

$$\text{diff. 1 4 0 de. at 3 a-penny.}$$

then, 1l. 4s. \times 3 = 288d. \times 3 = 864 eggs at 3 a-penny.

(91)



$$\begin{matrix} 98 \text{ ft. 6 in. : } 50 \text{ ft. 11 in. :: } 581 \text{ ft. 7 in. : } \\ 300 \text{ ft. } 7 \frac{6 \frac{6}{18} \frac{5}{18}}{18} \text{ in.} \end{matrix}$$

$$(92) \begin{matrix} 300 \text{ ft. } 7 \frac{6 \frac{6}{18} \frac{5}{18}}{18} \text{ in. : } 581 \text{ ft. 7 in. :: } 50 \text{ ft. 11 in.} \\ 98 \text{ ft. 6 in.} \end{matrix}$$

$$(93) \begin{matrix} 23 \text{ hrs. 56 min. : } 15540 \text{ miles :: } 60 \text{ min. : } \\ 649 \frac{19}{33} \text{ miles.} \end{matrix}$$

$$(94) \begin{matrix} 649 \frac{19}{33} \text{ miles : } 1 \text{ hr. :: } 15540 \text{ miles : } 23 \\ \text{hrs. 56 min.} \end{matrix}$$

$$(95) \begin{matrix} 33 \text{ min. 28 sec. : } 12 \text{ digits :: } 29 \text{ min. 28 sec.} \\ : 10 \text{ deg. } 33 \text{ min. } 56 \frac{16}{25} \frac{4}{25} \text{ sec.} \end{matrix}$$

$$(96) \begin{matrix} 10 \text{ deg. } 33 \text{ min. } 56 \frac{16}{25} \frac{4}{25} \text{ sec. : } 29 \text{ min. 28 sec.} \\ : 12 \text{ digits : } 33 \text{ min. 28 sec.} \end{matrix}$$

40 THE RULE OF THREE INVERSE.

- (97) First, $2290l. 10s. + 3 = 763l. 10s.$ value of the sugar; then, $1l. 3s. 3d. :: 1 \text{ cwt.} :: 763l. 10s. :: 656 \frac{1}{4} \text{ cwt. sugar}$; again, $2290l. 10s. - 763l. 10s. = 1527l.$ value of the wine; then, $43l. 16s. :: 1 \text{ ton} :: 1527l. :: 34 \frac{1}{8} \text{ tons of wine.}$
- (98) First, $2290l. 10s. + 3 = 763l. 10s.$ value of the sugar; then, $656 \frac{1}{4} \text{ cwt.} :: 763l. 10s. :: 1 \text{ cwt.} :: 1l. 3s. 3d.$ the sugar per cwt; again, $2290l. 10s. - 763l. 10s. = 1527l.$ value of the wine. Then $34 \frac{1}{8} \text{ tons} :: 1527l. :: 1 \text{ ton.} :: 43l. 16s.$ the wine per ton.
- (99) First, $4 \text{ hound's} :: 6 \text{ hare's} :: 120 \text{ hound's} :: 180 \text{ hare's paces}$; then, $4 \text{ hound's} :: 6 \text{ hare's} :: 12 \text{ hound's} :: 18 \text{ hare's paces, and } 18 \text{ hare's paces} - 16 \text{ do.} = 2 \text{ gain}$; hence, $2 \text{ hare's} :: 12 \text{ hound's} :: 180 \text{ hare's} :: 1080 \text{ hound's paces.}$
- (100) First, $12 \text{ hound's} :: 16 \text{ hare's} :: 4 \text{ hound's} :: 5 \frac{1}{2} \text{ hare's paces}$; then, $6 - 5 \frac{1}{2} = \frac{1}{2} \text{ hare's paces lost}$; and, $6 \text{ hare's} :: 4 \text{ hound's} :: \frac{1}{2} \text{ hare's} :: \frac{1}{2} \text{ hound's paces}$; whence, $4 \text{ hound's} :: \frac{1}{2} \text{ hound's} :: 1080 \text{ hound's} :: 120 \text{ hound's paces before the hare.}$
-

THE RULE OF THREE INVERSE.

The first example is worked.

- (2) $3 \text{ d.} :: 6 \text{ m.} :: 6 \text{ d.} :: 3 \text{ men.}$
- (3) $18 \text{ m.} :: 30 \text{ d.} :: 24 \text{ m.} :: 22\frac{1}{2} \text{ d.}$
- (4) $22\frac{1}{2} \text{ d.} :: 24 \text{ m.} :: 30 \text{ d.} :: 18 \text{ m.}$
- (5) $12 \text{ in.} :: 12 \text{ in.} :: 5 \text{ in.} :: 28\frac{1}{2} \text{ in.}$
- (6) $28\frac{1}{2} \text{ in. l.} :: 5 \text{ in. b.} :: 12 \text{ in. l.} :: 12 \text{ in. b.}$
- (7) $90l. :: 540l. :: 162l. :: 300l.$
- (8) $300l. :: 162l. :: 540l. :: 90l.$
- (9) $5s. :: 11 \text{ oz. 8 dwt.} :: 9s. 6d. :: 6 \text{ oz.}$
- (10) $6 \text{ oz.} :: 9s. 6d. :: 11 \text{ oz. 8 dwt.} :: 5s.$

THE RULE OF THREE INVERSE. 41

- (11) 8 m. : 7200 sol. :: 6 m. : 9600 sol. would consume the provisions in 6 months, hence $9600 - 7200 = 2400$ sol. must be added.
- (12) 9600 men : 6 mo. :: 7200 men : 8 mo.
- (13) 18 w. : 48 h. :: 8 w. : 108 h.
- (14) 108 h. : 8 w. :: 48 h. : 18 w.
- (15) 14 d. : 68 m. :: 4 d. : 238 m.
- (16) 238 m. : 4 d. :: 68 m. : 14 d.
- (17) 7 ft. 3 in. : 69 ft. :: 27 in. : 74 yds. 4 in.
- (18) 74 yds. 4 in. : 27 in. :: 69 ft. 87 in.
- (19) 5 qrs. : 550 yds. :: 3 qrs. : $916\frac{2}{3}$ yds.
- (20) $916\frac{2}{3}$ yds. : 3 qrs. :: 550 yds. : 5 qrs.
- (21) 160 λ . : 80 yrs. :: 1200 λ . : 4 yrs.
- (22) 4 yrs. : 1200 λ . :: 30 yrs. 160 λ .
- (23) 20 men : 87 w. 3 d. :: 12 men : 145 w. 5 d.
- (24) 145 w. 5 d. : 12 men :: 87 w. 3 d. : 20 m.
- (25) 8 p. b. : 20 p. l. :: 3 p. b. : $53\frac{1}{3}$ p. l.
- (26) $53\frac{1}{3}$ p. l. : 3 p. b. :: 20 p. l. : 8 p. b.
- (27) 200 sh. : 80 d. :: 800 sh. : 20 days.
- (28) 20 d. : 800 sh. :: 80 d. : 200 sh.
- (29) 45 c. : 4 w. :: 30 c. : 6 w.
- (30) 6 w. : 30 c. :: 4 w. : 45 c.
- (31) 16 ft. 3 in. : 18 ft. :: 2 ft. 6 in. : 117 ft.
= 39 yds.
- (32) 39 yds. : 2 ft. 6 in. :: 18 ft. : 16 ft. 3 in.
- (33) 80 miles : 15 cwt. 2 qr. 8 lb. :: 60 miles
: 20 cwt. 3 qrs. 1 $\frac{1}{2}$ lb.
- (34) 20 cwt. 3 qrs. 1 $\frac{1}{2}$ lb. : 60 miles :: 15 cwt.
2 qrs. 8 lb. : 80 miles
- (35) 3 h. : 1 c. :: $7\frac{1}{2}$ m. : 24 c.

COMPOUND PROPORTION.

(36) 24 c. : 7½ m. :: 1 c. : 3 h.



In the above Figure $a:b=120$ inches, $a:C=8$, P the power, or $1\frac{1}{4}$ cwt., and w the weight.

- (37) First, $120 \text{ in.} - 8 \text{ in.} = 112 \text{ in. } C P$; then, $112 \text{ in.} : 196 \text{ lb.} :: 8 \text{ in.} : 2744 \text{ lb.}$
 (38) $2744 \text{ lb.} : 8 \text{ in.} :: 196 \text{ lb.} : 112 \text{ in.}$
 (39) $5 \text{ ft. } 2 \text{ in.} : 9 \text{ ft. } 6 \text{ in.} :: 3 \text{ ft. } 4 \text{ in.} : 14 \text{ ft. } 8\frac{7}{10} \text{ in.}$
 (40) $14 \text{ ft. } 8\frac{7}{10} \text{ in.} : 3 \text{ ft. } 4 \text{ in.} :: 9 \text{ ft. } 6 \text{ in.} : 5 \text{ ft. } 2 \text{ in.}$
 (41) $9 \text{ h.} : 7 \text{ w.} :: 21 \text{ h.} : 3 \text{ w.}$
 (42) $3 \text{ w.} : 21 \text{ h.} :: 7 \text{ w.} : 9 \text{ h.}$

NOTE. Any question in the Rule of Three Inverse may be so stated, as to have its terms in direct proportion, by changing the places of the first and third terms in the question; thus, in the last example, $7 \text{ w.} : 21 \text{ h.} :: 3 \text{ w.} : 9 \text{ h.}$, as above.

COMPOUND PROPORTION.

Ex. (1) is worked.

$$(2) \text{ First, } *32 \text{ h.} : 24 \text{ b.} :: 16 \text{ h.} \\ *8d. : — :: 6d. \\ \text{then } \frac{24 \times 16 \times 6}{32 \times 8} = \frac{2304}{256} = 9 \text{ bus.}$$

Or, by two statings, thus,

First, $32 \text{ h.} : 24 \text{ b.} :: 16 \text{ h.} : 12 \text{ b.}$, the 4th term;
 then, $8 \text{ d.} : 12 \text{ b.} :: 6 \text{ d.} : 9 \text{ b.}$, as before.

In a similar manner may all the succeeding questions be stated.

COMPOUND PROPORTION.

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$$(3) \text{ First, } *40 \text{ s.} : 24l. :: 1500 \text{ s.} \\ *36 \text{ d.} : \underline{\quad} :: 32 \text{ d.} \\ \text{then, } \frac{24 \times 1500 \times 32}{40 \times 36} = \frac{1152000}{1440} = 800l.$$

$$(4) \text{ First, } *800l. : 1500 \text{ m.} :: 24l. \\ *36 \text{ d.} : \underline{\quad} :: 32 \text{ d.} \\ \text{then, } \frac{1500 \times 24 \times 32}{800 \times 36} = \frac{1152000}{28800} = 40 \text{ m.}$$

$$(5) \text{ First, } 9000 \text{ d.} : 14 \text{ f. l.} :: 12^* \text{ f. l.} \\ \underline{\quad} : 2\frac{1}{2} \text{ i. t.} :: 11^* \text{ i. t.} \\ \text{Here, } 2\frac{1}{2} = 5 \text{ halves, and } 1\frac{1}{2} = 3 \text{ halves;} \\ \text{then, } \frac{9000 \times 14 \times 5}{12 \times 3} = \frac{630000}{86} = 17500 \text{ deals.}$$

$$(6) \text{ First, } 17500 \text{ d.} : 12 \text{ f. l.} :: 14^* \text{ l.} \\ \underline{\quad} : 1\frac{1}{2} \text{ i. t.} :: 2\frac{1}{2}^* \text{ i. t.} \\ \text{Here, } 1\frac{1}{2} = 3 \text{ halves, and } 2\frac{1}{2} = 5 \text{ halves.} \\ \text{then, } \frac{17500 \times 12 \times 3}{14 \times 5} = \frac{630000}{70} = 9000 \text{ deals.}$$

$$(7) \text{ First, } 12000 \text{ m.} : 15 \text{ ozs.} :: 10000^* \text{ m.} \\ 32 \text{ w.} : \underline{\quad} :: 48^* \text{ w.} \\ \text{then, } \frac{12000 \times 15 \times 32}{10000 \times 48} = \frac{5760000}{480000} = 12 \text{ ozs.}$$

$$(8) \text{ First, } 10000 \text{ m.} : 12 \text{ ozs.} :: 12000^* \text{ m.} \\ 48 \text{ w.} : \underline{\quad} :: 32^* \text{ w.} \\ \text{then, } \frac{10000 \times 12 \times 48}{12000 \times 32} = \frac{5760000}{384000} = 15 \text{ ozs.}$$

$$(9) \text{ First, } *27 \text{ m.} : 36l. :: 72 \text{ m.} \\ *24 \text{ w.} : \underline{\quad} :: 48 \text{ w.} \\ \text{then, } \frac{36 \times 72 \times 48}{27 \times 24} = \frac{124416}{648} = 192l.$$

COMPOUND PROPORTION.

$$(10) \quad \begin{array}{l} *72 \text{ s.} : 192 \text{ l.} :: 27 \text{ s.} \\ *48 \text{ w.} : \underline{\quad} :: 24 \text{ w.} \\ 192 \times 27 \times 24 \quad 124416 \\ \text{then, } \frac{192 \times 27 \times 24}{72 \times 48} = \frac{124416}{3456} = 36 \text{l.} \end{array}$$

$$(11) \quad \begin{array}{l} *100 \text{ l.} : 5 \text{ l.} :: 144 \text{ l.} \\ *365 \text{ d.} : \underline{\quad} :: 486 \text{ d.} \\ 5 \times 144 \times 486 \quad 349920 \\ \text{then, } \frac{5 \times 144 \times 486}{100 \times 365} = \frac{349920}{36500} = 9 \text{l. } 11 \text{s. } 8\frac{1}{4}\frac{1}{3}\frac{1}{5} \text{d.} \end{array}$$

$$(12) \quad \begin{array}{l} *144 \text{ l.} : 9 \text{l. } 11 \text{s. } 8\frac{1}{4}\frac{1}{3}\frac{1}{5} \text{d.} :: 100 \text{ l.} \\ *486 \text{ d.} : \underline{\quad} :: 365 \text{ d.} \\ \text{First, } 9 \text{l. } 11 \text{s. } 8\frac{1}{4}\frac{1}{3}\frac{1}{5} \text{d.} = 9359095 \text{ three hundred and} \\ \text{sixty fifths of a farthing; then,} \\ \frac{3359095 \times 100 \times 365}{144 \times 486} = \frac{122611968000}{69984} = 1752000 \text{ three} \end{array}$$

hundred and sixty fifths of a farthing, which, being reduced, gives 5l. the ans.

$$(13) \quad \begin{array}{l} *6 \text{ d.} : 12 \text{ d.} :: 4 \text{ d.} \\ *8 \text{ p.} : \underline{\quad} :: 40 \text{ p.} \\ 12 \times 4 \times 40 \quad 1920 \\ \text{then, } \frac{12 \times 4 \times 40}{6 \times 8} = \frac{1920}{48} = 40 \text{ d.} \end{array}$$

$$(14) \quad \begin{array}{l} 12 \text{ m.} : 100 \text{ l.} :: 8* \text{ m.} \\ *5 \text{ : } \underline{\quad} :: 10 \text{ l.} \\ 100 \times 12 \times 10 \quad 12000 \\ \text{then, } \frac{100 \times 12 \times 10}{5 \times 8} = \frac{12000}{40} = 300 \text{ l.} \end{array}$$

$$(15) \quad \begin{array}{l} 8 \text{ m.} : 300 \text{ l.} :: 12* \text{ m.} \\ *10 \text{ l.} : \underline{\quad} :: 5 \text{ l.} \\ 8 \times 300 \times 5 \quad 12000 \\ \text{then, } \frac{8 \times 300 \times 5}{12 \times 10} = \frac{12000}{120} = 100 \text{ l.} \end{array}$$

PRACTICE.

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(16)	248 m. : 5 d. :: 24 m. *
	11 h. — 9 h. *
	7 d. — 4 d. *
	* 232 y. l. — 337 y. l.
	* 4 w. — 5 w.
	* 3 d. — 4 d.

then,

$$\frac{248 \times 11 \times 7 \times 5 \times 337 \times 5 \times 4}{232 \times 4 \times 3 \times 24 \times 9 \times 4} = \frac{643535200}{2805376} = 267\frac{1}{2} \text{ ds.}$$

(17)	4 c. : 16 d. :: 9 c. *
	12 h. — 10 h. *
	* 14 s. — 30 s.
	* 24 p. — 16 p.
	* 44 l. — 50 l.
	* 40 let. — 45 let.

$$\text{then, } \frac{16 \times 4 \times 12 \times 30 \times 16 \times 50 \times 45}{9 \times 10 \times 14 \times 24 \times 44 \times 40} = \frac{829440000}{53222400} = 15\frac{1}{4} \text{ da.}$$

PRACTICE.

Example (1) is worked.

2	2446 at $\frac{1}{2}d.$	$\frac{d.}{2} = \frac{1}{2}$	1426 at $\frac{3}{4}d.$
12	1223	$\frac{1}{4} = \frac{1}{2}$	713
2 0	10 1 11d.		356 6d.
£	5 1 11 Ans.		12 1069 6
			2 0 8 9 1 $\frac{1}{2}$
			£. 4 9 1 $\frac{1}{2}$

PRACTICE.

$$\begin{array}{r} \text{d.} \\ 12 \end{array} \left| \begin{array}{r} 1436 \text{ at } 1d. \\ \hline 1198 \\ \hline 5198 \\ \hline \end{array} \right. \quad (4)$$

$$\begin{array}{r} \text{d.} \\ 1\frac{1}{2} = \frac{1}{3} \end{array} \left| \begin{array}{r} 3224 \text{ at } 1\frac{1}{2}d. \\ \hline 403 \\ \hline 2030 \\ \hline \end{array} \right. \quad (5)$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{2} \end{array} \left| \begin{array}{r} 3640 \text{ at } 2d. \\ \hline 6068 \\ \hline 3068 \\ \hline \end{array} \right. \quad (6)$$

$$\begin{array}{r} \text{d.} \\ 3 = \frac{1}{4} \end{array} \left| \begin{array}{r} 642 \text{ at } 3d. \\ \hline 1606 \\ \hline 806 \\ \hline \end{array} \right. \quad (7)$$

$$\begin{array}{r} \text{d.} \\ 4 = \frac{1}{5} \end{array} \left| \begin{array}{r} 3641 \text{ at } 4d. \\ \hline 12138 \\ \hline 60138 \\ \hline \end{array} \right. \quad (8)$$

$$\begin{array}{r} \text{d.} \\ 6 = \frac{1}{2} \end{array} \left| \begin{array}{r} 341 \text{ at } 6d. \\ \hline 1706 \\ \hline 8106 \\ \hline \end{array} \right. \quad (9)$$

$$\begin{array}{r} \text{d.} \\ 18 = \frac{1}{15} \end{array} \left| \begin{array}{r} 346 \text{ at } 1s. 8d. \\ \hline 28168 \\ \hline \end{array} \right. \quad (10) \quad \begin{array}{r} \text{d.} \\ 2 = \frac{1}{10} \end{array} \left| \begin{array}{r} 842 \text{ at } 2s. * \\ \hline 8440 \\ \hline \end{array} \right. \quad (11)$$

$$\begin{array}{r} \text{d.} \\ 26 = \frac{1}{8} \end{array} \left| \begin{array}{r} 480 \text{ at } 2s. 6d. \\ \hline 60 \\ \hline \end{array} \right. \quad (12)$$

$$\begin{array}{r} \text{d.} \\ 34 = \frac{1}{6} \end{array} \left| \begin{array}{r} 962 \text{ at } 3s. 4d \\ \hline 16068 \\ \hline \end{array} \right. \quad (13)$$

* When the price is 2s. double the units' figure for shillings, and the rest of the product will be pounds.

$$\begin{array}{r} \text{d.} \\ 4 = \frac{1}{2} \end{array} \left| \begin{array}{l} (14) \\ 4060 \text{ at } 4s. \\ \hline 812 \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 5 = \frac{1}{2} \end{array} \left| \begin{array}{l} (15) \\ 120 \text{ at } 5s. \\ \hline 30 \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 6 8 = \frac{1}{2} \end{array} \left| \begin{array}{l} (16) \\ 904 \text{ at } 6s. 8d. \\ \hline 301 \cdot 6 8 \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 10 = \frac{1}{2} \end{array} \left| \begin{array}{l} (17) \\ 4116 \text{ at } 10s. \\ \hline 2058 \end{array} \right.$$

RULE II.

Example (18) is worked.

$$\begin{array}{r} \text{d.} \\ 1\frac{1}{2} = \frac{1}{2} \end{array} \left| \begin{array}{l} (19) \\ 342 \text{ at } 1\frac{1}{4}d. \\ \hline 42 \cdot 9 \\ 7 \quad 1\frac{1}{2} \\ \hline 2|0 \quad 4|9 \ 10\frac{1}{2} \\ \hline 2 \ 9 \ 10\frac{1}{2} \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{2} \end{array} \left| \begin{array}{l} (20) \\ 94 \text{ at } 2\frac{1}{4}d. \\ \hline 15 \ 8 \\ 1 \ 11\frac{1}{2} \\ \hline s. \quad 17 \ 7\frac{1}{2} \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{2} \end{array} \left| \begin{array}{l} (21) \\ 342 \text{ at } 2\frac{1}{2}d. \\ \hline 57 \\ 14 \quad 3 \\ \hline 2|0 \quad 7|1 \quad 3 \\ \hline 3-11 \quad 3 \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{2} \end{array} \left| \begin{array}{l} (22) \\ 432 \text{ at } 2\frac{3}{4}d. \\ \hline 72 \\ 18 \\ 9 \\ \hline 2|0 \quad 9|9 \\ \hline 4 \ 19 \end{array} \right.$$

PRACTICE.

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 \frac{1}{2} = \frac{1}{3} \\
 \frac{1}{4} = \frac{1}{2} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (35) \\
 984 \text{ at } 6\frac{1}{4}d. \\
 \hline
 492 \\
 41 \\
 20 \quad 6 \\
 \hline
 55|3 \quad 6 \\
 \hline
 27 \quad 13 \quad 6
 \end{array}
 \right.$$

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 1 = \frac{1}{3} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (36) \\
 842 \text{ at } 7d \\
 \hline
 421 \\
 70 \quad 2 \\
 \hline
 49|1 \quad 2 \\
 \hline
 24 \quad 11 \quad 2
 \end{array}
 \right.$$

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 1 = \frac{1}{3} \\
 \frac{1}{4} = \frac{1}{2} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (37) \\
 436 \text{ at } 7\frac{1}{4}d. \\
 \hline
 218 \\
 36 \quad 4 \\
 9 \quad 1 \\
 \hline
 26|3 \quad 5 \\
 \hline
 13 \quad 3 \quad 5
 \end{array}
 \right.$$

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 1 = \frac{1}{3} \\
 \frac{1}{2} = \frac{1}{2} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (38) \\
 4160 \text{ at } 7\frac{1}{2}d. \\
 \hline
 2080 \\
 346 \quad 8 \\
 173 \quad 4 \\
 \hline
 260 \quad 0 \quad 0 \\
 \hline
 130 \quad 0 \quad 0
 \end{array}
 \right.$$

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 1 = \frac{1}{3} \\
 \frac{1}{2} = \frac{1}{2} \\
 \frac{1}{4} = \frac{1}{2} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (39) \\
 896 \text{ at } 7\frac{3}{4}d. \\
 \hline
 448 \\
 74 \quad 8 \\
 37 \quad 4 \\
 18 \quad 8 \\
 \hline
 57|8 \quad 8 \\
 \hline
 28 \quad 18
 \end{array}
 \right.$$

$$\begin{array}{r}
 d. \\
 6 = \frac{1}{2} \\
 2 = \frac{1}{3} \\
 2|0 \\
 \mathcal{L}
 \end{array}
 \left|
 \begin{array}{r}
 (40) \\
 4960 \text{ at } 8d. \\
 \hline
 2480 \\
 826 \quad 8 \\
 \hline
 330|6 \quad 8 \\
 \hline
 165 \quad 6 \quad 8
 \end{array}
 \right.$$

PRACTICE.

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$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 960 \text{ at } 8\frac{1}{4}d. \\ \hline \end{array} \quad \begin{array}{r} (41) \\ \hline 480 \\ 160 \\ 20 \\ \hline 2|0 \quad 66|0 \\ \hline \mathcal{L} \quad 33 \\ \hline \end{array}$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 842 \text{ at } 8\frac{1}{2}d \\ \hline \end{array} \quad \begin{array}{r} (42) \\ \hline 421 \\ 140 \quad 4 \\ 35 \quad 1 \\ \hline 2|0 \quad 59|6 \quad 5 \\ \hline \mathcal{L} \quad 29 \quad 16 \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 123 \text{ at } 8\frac{1}{4}d. \\ \hline \end{array} \quad \begin{array}{r} (43) \\ \hline 61 \quad 6 \\ 20 \quad 6 \\ 5 \quad 1\frac{1}{2} \\ 2 \quad 6\frac{1}{4} \\ \hline 2|0 \quad 8|9 \quad 8\frac{1}{4} \\ \hline 4 \quad 9 \quad 8\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 842 \text{ at } 9d \\ \hline \end{array} \quad \begin{array}{r} (44) \\ \hline 421 \\ 210 \quad 6 \\ \hline 2|0 \quad 63|1 \quad 6 \\ \hline 31 \quad 11 \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 786 \text{ at } 9\frac{1}{4}d. \\ \hline \end{array} \quad \begin{array}{r} (45) \\ \hline 393 \\ 196 \quad 6 \\ 16 \quad 4\frac{1}{2} \\ \hline 2|0 \quad 60|5 \quad 10\frac{1}{2} \\ \hline 30 \quad 5 \quad 10\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 1212 \text{ at } 9\frac{1}{2}d \\ \hline \end{array} \quad \begin{array}{r} (46) \\ \hline 606 \\ 303 \\ 50 \quad 6 \\ \hline 2|0 \quad 95|9 \quad 6 \\ \hline 47 \quad 19 \quad 6 \\ \hline \end{array}$$

PRACTICE.

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ \frac{1}{4} = \frac{1}{4} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (47) \\ 644 \text{ at } 9\frac{3}{4}d. \\ \hline 322 \\ 161 \\ \hline 40 \quad 3 \\ \hline 52|3 \quad 3 \\ \hline 26 \quad 3 \quad 3 \\ \hline \end{array} \right.$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ 1 = \frac{1}{3} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (48) \\ 596 \text{ at } 10d. \\ \hline 298 \\ 149 \\ \hline 49 \quad 8 \\ \hline 49|6 \quad 8 \\ \hline 24 \quad 16 \quad 8 \\ \hline \end{array} \right.$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ 1 = \frac{1}{3} \\ \frac{1}{4} = \frac{1}{4} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (49) \\ 742 \text{ at } 10\frac{1}{4}d. \\ \hline 371 \\ 185 \quad 6 \\ 61 \quad 10 \\ 15 \quad 5\frac{1}{2} \\ \hline 63|3 \quad 9\frac{1}{2} \\ \hline 31 \quad 13 \quad 9\frac{1}{2} \\ \hline \end{array} \right.$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ 1 = \frac{1}{3} \\ \frac{1}{2} = \frac{1}{2} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (50) \\ 412 \text{ at } 10\frac{1}{2}d. \\ \hline 206 \\ 103 \\ 34 \quad 4 \\ 17 \quad 2 \\ \hline 36|0 \quad 6 \\ \hline 18 \quad 0 \quad 6 \\ \hline \end{array} \right.$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ 1 = \frac{1}{3} \\ \frac{1}{2} = \frac{1}{2} \\ \frac{1}{4} = \frac{1}{4} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (51) \\ 680 \text{ at } 10\frac{3}{4}d. \\ \hline 340 \\ 170 \\ 56 \quad 8 \\ 28 \quad 4 \\ 14 \quad 2 \\ \hline 60|9 \quad 2 \\ \hline 30 \quad 9 \quad 2 \\ \hline \end{array} \right.$$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 3 = \frac{1}{2} \\ 1\frac{1}{2} = \frac{1}{2} \\ \frac{1}{2} = \frac{1}{3} \\ \hline 2|0 \\ \hline \mathcal{L} \end{array} \left| \begin{array}{l} (52) \\ 1234 \text{ at } 11d. \\ \hline 617 \\ 308 \quad 6 \\ 154 \quad 3 \\ 51 \quad 5 \\ \hline 113|1 \quad 2 \\ \hline 56 \quad 11 \quad 2 \\ \hline \end{array} \right.$$

PRACTICE.

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$d = \frac{1}{2}$	(53)
6	3620 at $11\frac{1}{4}d.$
$\underline{\quad}$	$\underline{\quad}$
3	1810
$1\frac{1}{2}$	905
$\frac{1}{4} = \frac{1}{2}$	452 6
$\frac{1}{4} = \frac{1}{2}$	226 3
$\underline{\quad}$	$\underline{\quad}$
2 0	339 3 9
$\underline{\quad}$	$\underline{\quad}$
£	169 13 9
	$\underline{\quad}$

$d = \frac{1}{2}$	(54)
6	684 at $11\frac{1}{4}d.$
$\underline{\quad}$	$\underline{\quad}$
3	342
$1\frac{1}{2} = \frac{1}{2}$	171
$\frac{1}{4} = \frac{1}{2}$	85 6
$\frac{1}{4} = \frac{1}{2}$	42 9
$\underline{\quad}$	$\underline{\quad}$
2 0	14 3
$\underline{\quad}$	$\underline{\quad}$
£	65 5 6
	$\underline{\quad}$
	32 15 6

(55)

962 at $11\frac{1}{4}d.$

$d = \frac{1}{3}$	96 4s. the price 2s.*
$2 = \frac{1}{4}$	32 1 4
$1 = \frac{1}{2}$	8 0 4
$\frac{1}{2} = \frac{1}{4}$	4 0 2
$\frac{1}{4} = \frac{1}{2}$	2 0 1
$\underline{\quad}$	$\underline{\quad}$
£	1 0 0 $\frac{1}{2}$
	$\underline{\quad}$
	47 1 11 $\frac{1}{2}$

* In some cases, it will be more convenient to find the answer at 2s. as in note page 61, and divide that sum by its aliquot parts.

PRACTICE.

RULE III.

Example (56) is worked.

$$\begin{array}{r}
 d. \quad (57) \\
 4 = \frac{1}{3} \left| \begin{array}{r} 1241 \\ 2 \end{array} \right. \text{ at } 2s. 5d. \quad d. \quad (58) \\
 \hline
 2482 \quad 486 \quad \text{at } 3s. 8d. \\
 1 = \frac{1}{4} \left| \begin{array}{rr} 413 & 8 \\ 103 & 5 \end{array} \right. \quad 2 = \frac{1}{3} \left| \begin{array}{r} 1458 \\ 243 \\ 81 \end{array} \right. \\
 \hline
 2|0 \left| \begin{array}{r} 299 \\ 19 \end{array} \right. \quad 2|0 \left| \begin{array}{r} 178 \\ 2 \end{array} \right. \\
 \hline
 \cancel{2} \left| \begin{array}{r} 149 \\ 19 \end{array} \right. \quad \cancel{2} \left| \begin{array}{r} 89 \\ 20 \end{array} \right. \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (59) \\
 3 = \frac{1}{4} \left| \begin{array}{r} 642 \\ 4 \end{array} \right. \text{ at } 4s. 3d. \quad d. \quad (60) \\
 \hline
 2568 \quad 543 \quad \text{at } 5s. 11d. \\
 160 \quad 6 \quad 5 \quad \hline
 2|0 \left| \begin{array}{r} 272 \\ 8 \end{array} \right. \quad 271 \quad 6 \\
 \hline
 136 \quad 8 \quad 6 \quad 135 \quad 9 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 1 \frac{1}{2} = \frac{1}{2} \quad 67 \quad 10 \frac{1}{2} \\
 \frac{1}{2} = \frac{1}{3} \quad 22 \quad 7 \frac{1}{2} \\
 \hline
 2|0 \left| \begin{array}{r} 321 \\ 2 \end{array} \right. \quad 160 \quad 12 \quad 9 \\
 \hline
 \end{array}$$

PRACTICE.

55

<i>d.</i>	(61)	<i>d.</i>	(62)
$6 = \frac{1}{2}$	48 at 6s. $10\frac{1}{2}d.$	$6 = \frac{1}{2}$	412 at 7s. $7\frac{1}{2}d.$
	6		7
	—		—
	288		2884
3 = $\frac{1}{2}$	24	1 = $\frac{1}{2}$	206
1 = $\frac{1}{3}$	12		34 4
$\frac{1}{2} = \frac{1}{2}$	4		—
	2	2 0	312 4 4
	—		—
2 0	33 0		156 4 4
	—		—
£	16 10 0		—

<i>d.</i>	(63)	<i>d.</i>	(64)
$3 = \frac{1}{2}$	141 at 8s. $3\frac{1}{2}d.$	$6 = \frac{1}{2}$	364 at 9s. $7\frac{1}{2}d.$
	8		9
	—		—
	1128		3276
$\frac{1}{2} = \frac{1}{12}$	35 3	1 = $\frac{1}{2}$	182
	2 11 $\frac{1}{2}$	$\frac{1}{2} = \frac{1}{2}$	30 4
	—		15 2
2 0	116 6 2 $\frac{1}{2}$	2 0	350 3 6
	—		—
	58 6 2 $\frac{1}{2}$		175 3 6
	—		—

<i>d.</i>	(65)	<i>d.</i>	(66)
$4 = \frac{1}{3}$	891 at 10s. $5\frac{1}{2}d.$	$6 = \frac{1}{2}$	401 at 11s. $9\frac{1}{2}d.$
	10		11
	—		—
	8910		4411
1 = $\frac{1}{2}$	297	3 = $\frac{1}{2}$	200 6
$\frac{1}{2} = \frac{1}{6}$	74 3	$\frac{1}{2} = \frac{1}{6}$	100 3
	18 6 $\frac{3}{4}$		16 8 $\frac{1}{2}$
	—		—
2 0	929 9 9 $\frac{1}{4}$	2 0	472 8 5 $\frac{1}{2}$
	—		—
	464 19 9 $\frac{3}{4}$		236 8 5 $\frac{1}{2}$
	—		—

D 4

PRACTICE.

$$\begin{array}{r}
 d. \quad (67) \\
 6 = \frac{1}{2} \quad | \quad 481 \text{ at } 12s. 8d. \quad d. \quad (68) \\
 \underline{12} \qquad \qquad \qquad \underline{13} \\
 \\
 5772 \qquad \qquad \qquad 10413 \\
 2 = \frac{1}{3} \quad | \quad 240 \quad 6 \qquad \qquad 400 \quad 6 \\
 \underline{80} \quad 2 \qquad \qquad \qquad \underline{} \\
 \\
 2|0 \quad 609 \quad 2 \quad 8 \qquad \qquad 2|0 \quad 1081 \quad 3 \quad 6 \\
 \underline{} \qquad \qquad \qquad \underline{} \\
 \\
 \cancel{2} \quad 304 \quad 12 \quad 8 \qquad \qquad \cancel{2} \quad 540 \quad 13 \quad 6 \\
 \underline{} \qquad \qquad \qquad \underline{}
 \end{array}$$

$$\begin{array}{r}
 d. \quad (69) \\
 6 = \frac{1}{2} \quad | \quad 482 \text{ at } 14s. 8d. \quad d. \quad (70) \\
 \underline{14} \qquad \qquad \qquad \underline{15} \\
 \\
 6748 \qquad \qquad \qquad 4815 \\
 2 = \frac{1}{3} \quad | \quad 241 \qquad \qquad 3 = \frac{1}{2} \quad 160 \quad 6 \\
 \underline{80} \quad 4 \qquad \qquad \qquad \underline{80} \quad 3 \\
 \\
 2|0 \quad 706 \quad 9 \quad 4 \qquad \qquad 2|0 \quad 505 \quad 5 \quad 9 \\
 \underline{} \qquad \qquad \qquad \underline{} \\
 \\
 \underline{353} \quad 9 \quad 4 \qquad \qquad \underline{252} \quad 15 \quad 9
 \end{array}$$

$$\begin{array}{r}
 d. \quad (71) \\
 6 = \frac{1}{3} \quad | \quad 218 \text{ at } 16s. 10d. \quad d. \quad (72) \\
 \underline{16} \qquad \qquad \qquad \underline{17} \\
 \\
 3488 \qquad \qquad \qquad 7922 \\
 3 = \frac{1}{2} \quad | \quad 109 \qquad \qquad 155 \quad 4 \\
 1 = \frac{1}{3} \quad | \quad 54 \quad 6 \qquad \qquad \underline{} \\
 \underline{18} \quad 2 \qquad \qquad \qquad 2|0 \quad 807 \quad 7 \quad 4 \\
 \\
 2|0 \quad 366 \quad 9 \quad 8 \qquad \qquad \underline{} \\
 \underline{} \qquad \qquad \qquad \underline{} \\
 \\
 \underline{183} \quad 9 \quad 8 \qquad \qquad \underline{403} \quad 17 \quad 4
 \end{array}$$

PRACTICE.

57

$$\begin{array}{r|rr}
 d & (73) & d \\
 6 = \frac{1}{2} & 621 \text{ at } 18s. 6d. & 6 = \frac{1}{2} \\
 & 18 & \\
 \hline
 & 11178 & \\
 & 310 6 & \\
 \hline
 2|0 & 1148|8 6 & \\
 \hline
 & 574. 8 6 &
 \end{array}
 \quad
 \begin{array}{r|rr}
 d & (74) \\
 123 \text{ at } 19s. 10\frac{1}{2}d. & 19 \\
 \hline
 & 2397 \\
 & 61 6 \\
 & 30 9 \\
 & 10 3 \\
 & 5 1\frac{1}{2} \\
 \hline
 2|0 & 244|4 7\frac{1}{2} \\
 \hline
 & 122 4 7\frac{1}{2}
 \end{array}$$

RULE IV

Example (75) is worked.

$$\begin{array}{r|rr}
 s. d. & (76) & s. d. \\
 10 0 = \frac{1}{2} & 412 \text{ at } 1l. 16s. 7d. & 10 = \frac{1}{2} \\
 5 0 = \frac{1}{2} & 206 & \\
 1 0 = \frac{1}{5} & 103 & \\
 0 6 = \frac{1}{2} & 20 12 & \\
 0 1 = \frac{1}{6} & 10 6 & \\
 & 1 14 4 & \\
 \hline
 & 753 12 4 &
 \end{array}
 \quad
 \begin{array}{r|rr}
 & (77) \\
 & 244 \text{ at } 2l. 10s \\
 & 2 \\
 \hline
 & 488 \\
 & 122 \\
 \hline
 & 610
 \end{array}$$

$$\begin{array}{r|rr}
 s. & (78) & s. \\
 10 = \frac{1}{2} & 321 \text{ at } 3l. 15s. & 10 = \frac{1}{2} \\
 & 3 & \\
 \hline
 & 968 & \\
 & 160 10 & \\
 & 80 5 & \\
 \hline
 & 1203 15 &
 \end{array}
 \quad
 \begin{array}{r|rr}
 & (79) \\
 & 412 \text{ at } 4l. 16s \\
 & 4 \\
 \hline
 & 1648 \\
 & 206 \\
 & 103 \\
 & 20 12 \\
 \hline
 & 1977 12
 \end{array}$$

PRACTICE.

s. d.	(80)	s. d.	(81)
$5\ 0 = \frac{1}{2}$	146 at 5l. 6s. 6½d.	$5\ 0 = \frac{1}{2}$	432 at 6l. 7s. 6d.
	5		6
	—		—
	730		2592
1 0 = $\frac{1}{2}$	96 10	2 6 = $\frac{1}{2}$	108
0 6 = $\frac{1}{2}$	7 6		54
0 $\frac{1}{2}$ = $\frac{1}{12}$	3 18		—
	0 6 1		2754
	—		—
£	777 15 1		

s. d.	(82)	s. d.	(83)
$10 = \frac{1}{2}$	96 at 7l. 15s.	$10\ 0 = \frac{1}{2}$	100 at 8l. 16s. 4d.
	7		8
	—		—
	672		800
5 = $\frac{1}{2}$	48	5 0 = $\frac{1}{2}$	50
	24	1 0 = $\frac{1}{2}$	25
	—	0 4 = $\frac{1}{2}$	5
	744		1 13 4
	—		—
£			881 13 4

s. d.	(84)	s. d.	(85)
$10\ 0 = \frac{1}{2}$	220 at 12l. 10s.	$10 = \frac{1}{2}$	421 at 17l. 13s.
	12		17
	—		—
	2640		7157
	110	2 = $\frac{1}{2}$	210 10
	—	1 = $\frac{1}{2}$	42 2
	2750		21 1
	—		—
£			7430 13

PRACTICE.

59

$$\begin{array}{r}
 \text{s. d.} \\
 10 \text{ } 0 = \frac{1}{2} \quad | \quad \text{(86)} \\
 & 48 \text{ at } 18\text{l. } 19\text{s.} \\
 & 18 \\
 & \hline
 & 864 \\
 5 \text{ } 0 = \frac{1}{2} & | \quad 24 \\
 2 \text{ } 6 = \frac{1}{2} & | \quad 12 \\
 1 \text{ } 3 = \frac{1}{2} & | \quad 6 \\
 0 \text{ } 3 = \frac{1}{3} & | \quad 3 \\
 & \hline
 & 0 \quad 12 \\
 \mathcal{L} \quad | \quad 909 \quad 12 \\
 \hline
 \end{array}$$

RULE V.

Example (87) is worked.

$$\begin{array}{r}
 \text{(88)} \\
 222 \text{ at } 4\text{s.} \\
 2 \\
 \hline
 \mathcal{L} \quad \overline{44} \quad 8
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(89)} \\
 683 \text{ at } 6\text{s.} \\
 3 \\
 \hline
 \mathcal{L} \quad \overline{204} \quad 18
 \end{array}$$

$$\begin{array}{r}
 \text{(90)} \\
 482 \text{ at } 8\text{s.} \\
 4 \\
 \hline
 \overline{192} \quad 16
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(91)} \\
 422 \text{ at } 10\text{s.} \\
 5 \\
 \hline
 \overline{211} \quad 0
 \end{array}$$

$$\begin{array}{r}
 \text{(92)} \\
 683 \text{ at } 12\text{s.} \\
 6 \\
 \hline
 \overline{409} \quad 16
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(93)} \\
 684 \text{ at } 14\text{s.} \\
 7 \\
 \hline
 \overline{478} \quad 16
 \end{array}$$

PRACTICE.

$$\begin{array}{r}
 (94) \\
 322 \text{ at } 16s. \\
 8 \\
 \hline
 \mathcal{L} 257 12
 \end{array}
 \qquad
 \begin{array}{r}
 (95) \\
 344 \text{ at } 18s \\
 9 \\
 \hline
 \mathcal{L} 309 12
 \end{array}$$

$$\begin{array}{r}
 (96) \\
 242 \text{ at } 34s \\
 17 \\
 \hline
 411 8
 \end{array}
 \qquad
 \begin{array}{r}
 (97) \\
 364 \text{ at } 56s. \\
 28 \\
 \hline
 291 4 \\
 728 \\
 \hline
 1019 4
 \end{array}$$

$$\begin{array}{r}
 (98) \\
 482 \text{ at } 80s. \\
 40 \\
 \hline
 1928 0
 \end{array}
 \qquad
 \begin{array}{r}
 (99) \\
 \frac{1}{2}) 365 \text{ at } 11s. \\
 5\frac{1}{2} \\
 \hline
 182 10 \\
 18 5 \\
 \hline
 200 15
 \end{array}$$

$$\begin{array}{r}
 (100) \\
 \frac{1}{2}) 246 \text{ at } 17s. \\
 8\frac{1}{2} \\
 \hline
 196 16 \\
 12 6 \\
 \hline
 209 2
 \end{array}
 \qquad
 \begin{array}{r}
 (101) \\
 \frac{1}{2}) 690 \text{ at } 6s. 8d. \\
 3\frac{1}{2} = 3s. 4d. \\
 \hline
 207 0 \\
 23 0 \\
 \hline
 230 0
 \end{array}$$

This Rule is universally good for multiplying half any number of shillings, and also pence, into the given quantity. The double of the right-hand figure and overplus fraction (if any) of that product will be shillings, and the rest of the figures pounds, for the answer.

PRACTICE.

61

RULE VI.

$$\begin{array}{r}
 \text{grs. lb.} \quad (102) \\
 1 \ 0 = \frac{1}{4} \left| \begin{array}{r} \text{£} \\ 1 \ 5 \\ 4 \\ \hline 5 \ 0 \\ 0 \ 6 \ 3 \\ \hline \end{array} \right. \\
 \mathcal{L} \left| \begin{array}{r} 5 \ 6 \ 3 \\ \hline \end{array} \right.
 \end{array}
 \qquad
 \begin{array}{l}
 \text{Or thus.} \\
 1 = \frac{1}{4} \left| \begin{array}{r} \text{£} \\ 1 \ 5 \\ \hline 0 \ 6 \ 3 \end{array} \right. \\
 5 = \frac{1}{4} \left| \begin{array}{r} \text{cut.} \\ 4 \\ 1 \\ 0 \ 6 \ 3 \\ \hline 5 \ 6 \ 3 \end{array} \right.
 \end{array}$$

$$\begin{array}{r}
 \text{grs. lb.} \quad (103) \\
 2 \ 0 = \frac{1}{2} \left| \begin{array}{r} \text{£} \quad \text{s.} \quad \text{a.} \\ 2 \ 6 \ 4 \\ 3 \\ \hline 6 \ 19 \ 0 \\ 1 \ 3 \ 2 \\ 0 \ 5 \ 9\frac{1}{2} \\ \hline 8 \ 7 \ 11\frac{1}{2} \\ \hline \end{array} \right. \\
 \mathcal{L} \left| \begin{array}{r} 8 \ 7 \ 11\frac{1}{2} \\ \hline \end{array} \right.
 \end{array}
 \qquad
 \begin{array}{r}
 \text{grs. lb.} \quad (104) \\
 2 \ 0 = \frac{1}{2} \left| \begin{array}{r} \text{£} \quad \text{s.} \\ 6 \ 16 \\ 6 \times 12 = 72 \\ \hline 40 \ 16 \\ 12 \\ \hline 489 \ 12 \\ 3 \ 8 \\ 1 \ 14 \\ 0 \ 17 \\ 0 \ 8 \ 6 \\ \hline 495 \ 19 \ 6 \\ \hline \end{array} \right. \\
 \mathcal{L} \left| \begin{array}{r} 495 \ 19 \ 6 \\ \hline \end{array} \right.
 \end{array}$$

PRACTICE.

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 644 \text{ at } 9\frac{3}{4}d. \end{array}$$

$\begin{array}{r} 47, \\ \hline 322 \\ 161 \\ \hline 40 \quad 3 \\ \hline 2|0 \quad 52|3 \quad 3 \\ \hline \mathcal{E} \quad 26 \quad 3 \quad 3 \end{array}$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 596 \text{ at } 10d. \end{array}$$

$\begin{array}{r} 48) \\ \hline 298 \\ 149 \\ \hline 49 \quad 8 \\ \hline 2|0 \quad 49|6 \quad 8 \\ \hline \mathcal{E} \quad 24 \quad 16 \quad 8 \end{array}$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 742 \text{ at } 10\frac{1}{4}d. \end{array}$$

$\begin{array}{r} 49) \\ \hline 371 \\ 185 \quad 6 \\ 61 \quad 10 \\ \hline 15 \quad 5\frac{1}{2} \\ \hline 2|0 \quad 63|3 \quad 9\frac{1}{2} \\ \hline 31 \quad 13 \quad 9\frac{1}{2} \end{array}$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 412 \text{ at } 10\frac{1}{2}d. \end{array}$$

$\begin{array}{r} 50) \\ \hline 206 \\ 103 \\ 34 \quad 4 \\ 17 \quad 2 \\ \hline 2|0 \quad 36|0 \quad 6 \\ \hline 18 \quad 0 \quad 6 \end{array}$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 680 \text{ at } 10\frac{3}{4}d. \end{array}$$

$\begin{array}{r} 51) \\ \hline 340 \\ 170 \\ 56 \quad 8 \\ 28 \quad 4 \\ 14 \quad 2 \\ \hline 2|0 \quad 60|9 \quad 2 \\ \hline 30 \quad 9 \quad 2 \end{array}$

$$\begin{array}{r} d. \\ 6 = \frac{1}{2} \\ \hline 1234 \text{ at } 11d. \end{array}$$

$\begin{array}{r} 52) \\ \hline 617 \\ 308 \quad 6 \\ 154 \quad 3 \\ 51 \quad 5 \\ \hline 2|0 \quad 113|1 \quad 2 \\ \hline 56 \quad 11 \quad 2 \end{array}$

PRACTICE.

58.

$$\begin{array}{r|l} d & (53) \\ \hline 6 = \frac{1}{2} & 3620 \text{ at } 11\frac{1}{4}d. \\ \hline 3 = \frac{1}{2} & 1810 \\ 1\frac{1}{2} = \frac{3}{2} & 905 \\ \frac{3}{4} = \frac{1}{2} & 452 \quad 6 \\ & 226 \quad 3 \\ \hline 2|0 & 339 \quad 3 \quad 9 \\ \hline & 169 \quad 13 \quad 9 \\ \hline \mathcal{L} & \end{array}$$

$$\begin{array}{r|l} d & (54) \\ \hline 6 = \frac{1}{2} & 684 \text{ at } 11\frac{1}{4}d. \\ \hline 3 = \frac{1}{2} & 342 \\ 1\frac{1}{2} = \frac{3}{2} & 171 \\ \frac{3}{4} = \frac{1}{2} & 85 \quad 6 \\ & 42 \quad 9 \\ & 14 \quad 3 \\ \hline 2|0 & 65 \quad 5 \quad 6 \\ \hline \mathcal{L} & 32 \quad 15 \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r|l} d & (55) \\ \hline 8 = \frac{1}{4} & 962 \text{ at } 11\frac{1}{4}d. \\ \hline & 96 \text{ 4s. the price 2s.*} \\ \hline 2 = \frac{1}{4} & 32 \quad 1 \quad 4 \\ 1 = \frac{1}{2} & 8 \quad 0 \quad 4 \\ \frac{1}{2} = \frac{1}{4} & 4 \quad 0 \quad 2 \\ \frac{1}{4} = \frac{1}{4} & 2 \cdot 0 \quad 1 \\ & 1 \cdot 0 \quad 0\frac{1}{2} \\ \hline \mathcal{L} & 47 \quad 1 \quad 11\frac{1}{2} \\ \hline \end{array}$$

* In some cases, it will be more convenient (to find the answer at 2s. as in note page 61, and divide that sum by its aliquot parts.

PRACTICE.

RULE III.

Example (56) is worked.

$$\begin{array}{r}
 d. \quad (57) \\
 4 = \frac{1}{3} \quad | \quad 1241 \text{ at } 2s. 5d. \\
 \underline{2} \\
 \hline
 2482 \\
 1 = \frac{1}{3} \quad | \quad 413 \quad 8 \\
 \underline{103} \quad 5 \\
 \hline
 2|0 \quad 299|9 \quad 1 \\
 \hline
 \cancel{2} \quad 149 \quad 19 \quad 1
 \end{array}
 \qquad
 \begin{array}{r}
 d. \quad (58) \\
 6 = \frac{1}{2} \quad | \quad 486 \text{ at } 3s. 8d. \\
 \underline{3} \\
 \hline
 1458 \\
 2 = \frac{1}{2} \quad | \quad 243 \\
 \underline{81} \\
 \hline
 2|0 \quad 178|2 \\
 \hline
 \cancel{2} \quad 89 \quad 2 \quad 0
 \end{array}$$

$$\begin{array}{r}
 d. \quad (59) \\
 3 = \frac{1}{4} \quad | \quad 642 \text{ at } 4s. 3d. \\
 \underline{4} \\
 \hline
 2568 \\
 160 \quad 6 \\
 \hline
 2|0 \quad 272|8 \quad 6 \\
 \hline
 136 \quad 8 \quad 6
 \end{array}
 \qquad
 \begin{array}{r}
 d. \quad (60) \\
 6 = \frac{1}{2} \quad | \quad 543 \text{ at } 5s. 11d. \\
 \underline{5} \\
 \hline
 2715 \\
 271 \quad 6 \\
 1\frac{1}{2} = \frac{1}{2} \quad | \quad 135 \quad 9 \\
 \underline{67} \quad 10\frac{1}{2} \\
 22 \quad 7\frac{1}{2} \\
 \hline
 2|0 \quad 321|2 \quad 9 \\
 \hline
 160 \quad 12 \quad 9
 \end{array}$$

PRACTICE.

55

$$\begin{array}{r|l}
 d. & (61) \\
 6 = \frac{1}{2} & 48 \text{ at } 6s. 10\frac{1}{2}d. \\
 & 6 \\
 & \hline
 & 288 \\
 3 = \frac{1}{2} & 24 \\
 1 = \frac{1}{3} & 12 \\
 \frac{1}{2} = \frac{1}{2} & 4 \\
 & 2 \\
 & \hline
 2|0 & 33|0 \\
 & \hline
 & 16 \ 10 \ 0
 \end{array}
 \quad
 \begin{array}{r|l}
 d. & (62) \\
 6 = \frac{1}{2} & 412 \text{ at } 7s. 7d. \\
 & 7 \\
 & \hline
 & 2884 \\
 1 = \frac{1}{6} & 206 \\
 & 34 \ 4 \\
 & \hline
 2|0 & 312|4 \ 4 \\
 & \hline
 & 156 \ 4 \ 4
 \end{array}$$

$$\begin{array}{r|l}
 d. & (63) \\
 3 = \frac{1}{3} & 141 \text{ at } 8s. 3\frac{1}{4}d. \\
 & 8 \\
 & \hline
 & 1128 \\
 \frac{1}{3} = \frac{1}{12} & 35 \ 3 \\
 & 2 \ 11\frac{1}{4} \\
 & \hline
 2|0 & 116|6 \ 2\frac{1}{4} \\
 & \hline
 & 58 \ 6 \ 2\frac{1}{4}
 \end{array}
 \quad
 \begin{array}{r|l}
 d. & (64) \\
 6 = \frac{1}{2} & 364 \text{ at } 9s. 7\frac{1}{2}d. \\
 & 9 \\
 & \hline
 & 3276 \\
 1 = \frac{1}{6} & 182 \\
 \frac{1}{2} = \frac{1}{2} & 30 \ 4 \\
 & 15 \ 2 \\
 & \hline
 2|0 & 350|3 \ 6 \\
 & \hline
 & 175 \ 3 \ 6
 \end{array}$$

$$\begin{array}{r|l}
 d. & (65) \\
 4 = \frac{1}{4} & 891 \text{ at } 10s. 5\frac{1}{4}d. \\
 & 10 \\
 & \hline
 & 8910 \\
 1 = \frac{1}{4} & 297 \\
 \frac{1}{4} = \frac{1}{4} & 74 \ 3 \\
 & 18 \ 6\frac{3}{4} \\
 & \hline
 2|0 & 929|9 \ 9\frac{1}{4} \\
 & \hline
 & 464 \ 19 \ 9\frac{3}{4}
 \end{array}
 \quad
 \begin{array}{r|l}
 d. & (66) \\
 6 = \frac{1}{2} & 401 \text{ at } 11s. 9\frac{1}{2}d. \\
 & 11 \\
 & \hline
 & 4411 \\
 3 = \frac{1}{3} & 200 \ 6 \\
 \frac{1}{2} = \frac{1}{6} & 100 \ 3 \\
 & 16 \ 8\frac{1}{2} \\
 & \hline
 2|0 & 472|8 \ 5\frac{1}{2} \\
 & \hline
 & 236 \ 8 \ 5\frac{1}{2}
 \end{array}$$

D 4

PRACTICE.

$d.$	(67)	$d.$	(68)
$6 = \frac{1}{2}$	481 at 12s. 8d.	$6 = \frac{1}{2}$	801 at 13s. 6d.
	12		13
	—		—
	5772		10413
$2 = \frac{1}{3}$	240 6		400 6
	80 2		—
	—	2 0	1081 3 6
$2 0$	609 2 8		—
	—		—
	304 12 8		540 13 6
	—		—

$d.$	(69)	$d.$	(70)
$6 = \frac{1}{2}$	482 at 14s. 8d.	$6 = \frac{1}{2}$	321 at 15s. 9d.
	14		15
	—		—
	6748		4815
$2 = \frac{1}{3}$	241		160 6
	80 4		80 3
	—	2 0	—
$2 0$	706 9 4		505 5 9
	—		—
	353 9 4		252 15 9
	—		—

$d.$	(71)	$d.$	(72)
$6 = \frac{1}{2}$	218 at 16s. 10d.	$4 = \frac{1}{3}$	466 at 17s. 4d.
	16		17
	—		—
	3488		7922
$3 = \frac{1}{2}$	109		155 4
$1 = \frac{1}{3}$	54 6		—
	18 2		—
	—	2 0	807 7 4
$2 0$	366 9 8		—
	—		—
	183 9 8		403 17 4
	—		—

PRACTICE.

67

$$\begin{array}{c}
 I \\
 4 = \frac{1}{3} \\
 \left| \begin{array}{ccccc}
 F. & I. & & & \\
 12 & 6 & \text{by } 8 & 5 & \\
 & 8 & & & \\
 \hline
 100 & 0 & & & \\
 4 & 2 & & & \\
 1 & 0 & 6 & & \\
 \hline
 105 & 2 & 6 & & \\
 \end{array} \right. \\
 1 = \frac{1}{4} \\
 \left| \begin{array}{ccccc}
 F. & I. & & & \\
 26 & 4 & \text{by } 12 & 7 & \\
 & 12 & & & \\
 \hline
 316 & 0 & & & \\
 13 & 2 & & & \\
 2 & 2 & 4 & & \\
 \hline
 331 & 4 & 4 & & \\
 \end{array} \right.
 \end{array}$$

$$\begin{array}{c}
 I \\
 8 = \frac{1}{4} \\
 \left| \begin{array}{ccccc}
 F. & I. & F. & I. & I. \\
 76 & 6 & \text{by } 48 & 3 & 6 = \frac{1}{2} \\
 6 \times 8 = 48. & & & & \\
 \hline
 459 & 0 & & & \\
 & 8 & & & \\
 \hline
 3672 & 0 & & & \\
 19 & 1 & 6 & & \\
 \hline
 3691 & 1 & 6 & & \\
 \end{array} \right. \\
 (5) \\
 \left| \begin{array}{ccccc}
 F. & I. & F. & I. & I. \\
 38 & 7 & \text{by } 45 & 6 & \\
 9 \times 5 = 45. & & & & \\
 \hline
 347 & 3 & & & \\
 & 5 & & & \\
 \hline
 1736 & 3 & & & \\
 19 & 3 & 6 & & \\
 \hline
 1755 & 6 & 6 & & \\
 \end{array} \right. \\
 (6)
 \end{array}$$

$$\begin{array}{c}
 I. \\
 2 = \frac{1}{8} \\
 \left| \begin{array}{ccccc}
 F. & I. & F. & I. & I. \\
 79 & 2 & \text{by } 84 & 2 & 3 = \frac{1}{4} \\
 12 \times 7 = 84. & & & & \\
 \hline
 950 & 0 & & & \\
 & 7 & & & \\
 \hline
 6650 & 0 & & & \\
 13 & 2 & 4 & & \\
 \hline
 6663 & 2 & 4 & & \\
 \end{array} \right. \\
 (7) \\
 \left| \begin{array}{ccccc}
 F. & I. & F. & I. & I. \\
 126 & 6 & \text{by } 121 & 3 & \\
 11 \times 11 = 121. & & & & \\
 \hline
 1391 & 6 & & & \\
 & 11 & & & \\
 \hline
 15306 & 6 & & & \\
 31 & 7 & 6 & & \\
 \hline
 15338 & 1 & 6 & & \\
 \end{array} \right. \\
 (8)
 \end{array}$$

PRACTICE.

s. d.	(80)	s. d.	(81)
$5\ 0 = \frac{1}{2}$	146 at 5l. 6s. 6½d.	$5\ 0 = \frac{1}{2}$	432 at 6l. 7s. 6d.
	5		6
	—		—
	730		2592
1 0 = $\frac{1}{2}$	36 10	2 6 = $\frac{1}{2}$	108
0 6 = $\frac{1}{2}$	7 6		54
0 $\frac{1}{2} = \frac{1}{12}$	3 18		—
	0 6 1		2754
	—		—
£	777 15 1		
	—		

s. d.	(82)	s. d.	(83)
$10 = \frac{1}{2}$	96 at 7l. 15s.	$10\ 0 = \frac{1}{2}$	100 at 8l. 16s. 4d.
	7		8
	—		—
	672		800
5 = $\frac{1}{2}$	48	5 0 = $\frac{1}{2}$	50
	24	1 0 = $\frac{1}{2}$	25
	—	0 4 = $\frac{1}{3}$	5
	744		1 13 4
	—		—
			881 13 4
			—

s. d.	(84)	s. d.	(85)
$10\ 0 = \frac{1}{2}$	220 at 12l. 10s.	$10 = \frac{1}{2}$	421 at 17l. 13s.
	12		17
	—		—
	2640		7157
	110		210 10
	—		42 2
	2750		21 1
	—		—
			7430 13
			—

PRACTICE.

59

$$\begin{array}{r}
 \text{s. d.} \\
 10\ 0 = \frac{1}{2} \\
 \hline
 48 \text{ at } 18\text{l. } 19\text{s.} \\
 18 \\
 \hline
 864 \\
 24 \\
 12 \\
 6 \\
 3 \\
 0\ 12 \\
 \hline
 \mathcal{L}\ 909\ 12
 \end{array}
 \quad (86)$$

RULE V.

Example (87) is worked.

$$\begin{array}{r}
 (88) \\
 222 \text{ at } 4\text{s.} \\
 2 \\
 \hline
 \mathcal{L}\ 44\ 8
 \end{array}
 \qquad
 \begin{array}{r}
 (89) \\
 683 \text{ at } 6\text{s.} \\
 3 \\
 \hline
 \mathcal{L}\ 204\ 18
 \end{array}$$

$$\begin{array}{r}
 (90) \\
 482 \text{ at } 8\text{s.} \\
 4 \\
 \hline
 192\ 16
 \end{array}
 \qquad
 \begin{array}{r}
 (91) \\
 422 \text{ at } 10\text{s.} \\
 5 \\
 \hline
 211\ 0
 \end{array}$$

$$\begin{array}{r}
 (92) \\
 683 \text{ at } 12\text{s.} \\
 6 \\
 \hline
 409\ 16
 \end{array}
 \qquad
 \begin{array}{r}
 (93) \\
 684 \text{ at } 14\text{s.} \\
 7 \\
 \hline
 478\ 16
 \end{array}$$

PRACTICE.

		(19)			
I. P.	F.	I.	P.		
1 0 = $\frac{1}{2}$	371	2	3		
2 0 = $\frac{1}{6}$	181	1	3		
	371				
	2968				
	371				
0 3 = $\frac{1}{4}$	30	11	2	3	
	7	8	9	6	9
0 3 = $\frac{1}{8}$	30	2	0	0	0
	3	9	3	0	0
	67223	7	2	9	9

		(20)			
I. P.	F.	I.	P.		
4 0 = $\frac{1}{5}$	487	10	10		
6 0 = $\frac{1}{2}$	186	5	6		
	2922				
	3896				
	487				
1 0 = $\frac{1}{4}$	162	7	7	4	
0 6 = $\frac{1}{3}$	40	7	10	10	
	20	3	11	5	
3 0 = $\frac{1}{2}$	98	0	0	0	
1 0 = $\frac{1}{3}$	46	6	0	0	
0 6 = $\frac{1}{2}$	15	6	0	0	
0 3 = $\frac{1}{3}$	7	9	0	0	
0 1 = $\frac{1}{4}$	3	10	6	0	
	1	3	6	0	
	90973	6	5	7	

PRACTICE.

71

$$I. \quad 2 = \frac{1}{2} \left| \begin{array}{cc} F. & I. \\ 18 & 6 \end{array} \right. \text{ by } 1 \quad \left| \begin{array}{cc} F. & I. \\ 1 & 2 \end{array} \right. \\ \begin{array}{c} 3 \\ 1 \end{array} \\ \hline \begin{array}{c} 21 \\ 7 \end{array}$$

$$I. \quad 4 = \frac{1}{4} \left| \begin{array}{cc} F. & I. \\ 45 & 6 \end{array} \right. \text{ by } 9 \quad \left| \begin{array}{cc} F. & I. \\ 9 & 4 \end{array} \right. \\ \hline \begin{array}{c} 409 \\ 15 \\ 2 \end{array} \\ \hline \begin{array}{c} 424 \\ 8 \end{array}$$

$$I. \quad 6 = \frac{1}{2} \left| \begin{array}{cc} F. & I. \\ 47 & 8 \end{array} \right. \text{ by } 64 \quad \left| \begin{array}{cc} F. & I. \\ 6 & 6 \end{array} \right. \\ \begin{array}{c} 8 \times 8 = 64. \end{array} \\ \hline \begin{array}{c} 381 \\ 8 \end{array} \\ \hline \begin{array}{c} 3050 \\ 23 \\ 10 \end{array} \\ \hline \begin{array}{c} 3074 \\ 6 \end{array} \\ \hline \begin{array}{c} 341 \\ 5 \\ 6 \end{array}$$

$$I. \quad 6 = \frac{1}{2} \left| \begin{array}{cc} F. & I. \\ 864 & 3 \end{array} \right. \text{ by } 62 \quad \left| \begin{array}{cc} F. & I. \\ 6 & 6 \end{array} \right. \\ \begin{array}{c} 6 \times 10 + 2 = 62 \end{array} \\ \hline \begin{array}{c} 5185 \\ 10 \end{array} \\ \hline \begin{array}{c} 51855 \\ 1728 \\ 6 \end{array} \\ \hline \begin{array}{c} 432 \\ 1 \\ 6 \end{array} \\ \hline \begin{array}{c} 54015 \\ 7 \\ 6 \end{array} \\ \hline \begin{array}{c} 6001 \\ 6 \\ 7 \\ 6 \end{array}$$

$$(25) \quad \left| \begin{array}{cc} F. & I. \\ 60 & 9 \end{array} \right. \text{ by } 22 \quad \left| \begin{array}{cc} F. & I. \\ 22 & 3 \end{array} \right. \\ \begin{array}{c} 2 \times 11 = 22. \end{array} \\ \hline \begin{array}{c} 121 \\ 6 \\ 11 \end{array} \\ \hline \begin{array}{c} 1336 \\ 15 \\ 2 \\ 3 \end{array} \\ \hline \begin{array}{c} 9)1351 \\ 150 \\ 1 \\ 8 \\ 3 \end{array}$$

$$(26) \quad \left| \begin{array}{cc} F. & I. \\ 40 & 6 \end{array} \right. \text{ by } 9 \quad \left| \begin{array}{cc} F. & I. \\ 9 & 3 \end{array} \right. \\ \hline \begin{array}{c} 364 \\ 10 \\ 1 \\ 6 \end{array} \\ \hline \begin{array}{c} 9)374 \\ 36 \\ 7 \\ 6 \end{array} \\ \hline \begin{array}{c} 41 \\ 5 \\ 7 \\ 6 \end{array}$$

PRACTICE.

$$\begin{array}{r}
 I. P. \\
 4 0 = \frac{1}{3} \\
 0 6 = \frac{1}{8}
 \end{array}
 \left| \begin{array}{r}
 F. \\
 3 8 9 \text{ by } 1 4 6 \\
 1 2 11 \\
 0 1 10 4 6 \\
 \hline
 5 1 6 4 6
 \end{array} \right. \quad (27)$$

$$\begin{array}{r}
 I. P. \\
 4 0 = \frac{1}{3} \\
 1 0 = \frac{1}{4} \\
 0 1 = \frac{1}{12}
 \end{array}
 \left| \begin{array}{r}
 F. I. P. \\
 3 7 9 \text{ by } 1 5 1 \\
 1 2 7 \\
 0 3 7 9 \\
 0 0 3 7 9 \\
 \hline
 5 2 3 4 9 \\
 35 \times = 15 \\
 \hline
 15 6 10 2 3 \\
 5 \\
 \hline
 77 10 2 11 3
 \end{array} \right. \quad (28)$$

$$\begin{array}{r}
 I. P. \\
 3 0 = \frac{1}{4} \\
 3 0 = \frac{1}{4}
 \end{array}
 \left| \begin{array}{r}
 F. I. \\
 1 6 \text{ breadth by } 1 3 \text{ depth.} \\
 0 4 6 \\
 \hline
 1 10 6 \\
 4 \times 4 = 16 \\
 \hline
 7 6 0 \\
 4 \\
 \hline
 30 0 0 \\
 0 5 7 6 \\
 \hline
 30 5 7 6 \text{ solid content.}
 \end{array} \right. \quad (29)$$

TARE AND TRET.

73

			(30)		
I. P.	F.	I. P.	F.	I. P.	
2 0 = $\frac{1}{4}$	1	5	6	breadth by 1	2 10 depth
0 8 = $\frac{1}{3}$	0	2	11		
0 2 = $\frac{1}{2}$	0	0	11	8	
	0	0	2	11	
<hr/>			<hr/>		
3 0 = $\frac{1}{4}$	1	9	7	I. P.	F. I. P.
				12+3	7=12 3 7 length
<hr/>			<hr/>		
0 6 = $\frac{1}{5}$	21	7	7	0	
0 1 = $\frac{1}{6}$	0	5	4	10	9
	0	0	10	9	9 6
	0	0	1	9	7 7
<hr/>			<hr/>		
	22	2	0	6	2 1 solid content
<hr/>			<hr/>		

TARE AND TRET.

No. (1) is worked.

(2)					
lb.	C.	gr.	lb.		
	9	2	8		
14			8		
8			<hr/>		
	76	2	8	gross	
112=	1	0	0	tare	
<hr/>					
Ans. 75 2 8 neat weight					
<hr/>					
76 2 8 proof					
<hr/>					

TARE AND TREW.

$$\begin{array}{r}
 \text{lb.} \qquad \qquad \qquad (3) \\
 28 \\
 14 \\
 \hline
 28 \left\{ \begin{array}{r} 4)322 \\ \hline 7)80 \quad 2 \\ \hline 4)11 \quad 3 \\ \hline \end{array} \right\} 14 \text{lb.} \qquad \begin{array}{r} C. \quad gr. \quad lb. \\ 5 \quad 2 \quad 5 \\ \hline 2 \times 7 = 14 \end{array} \\
 \text{Tare } 2 \ 3 \ 14 = \underline{\underline{2 \ 3 \ 14}} \text{ tare} \qquad \begin{array}{r} 11 \ 0 \ 10 \\ \hline 7 \\ \hline 77 \ 2 \ 14 \text{ gross} \end{array} \\
 \text{Ans. } 74 \ 3 \ 0 \text{ neat weight} \\
 \hline
 \begin{array}{r} 77 \ 2 \ 14 \text{ proof} \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \qquad \qquad \qquad (4) \\
 24 \\
 10 \\
 \hline
 \text{Tare } 2 \ 0 \ 16 \qquad \begin{array}{r} 11 \ 0 \ 4 \\ \hline 4 \\ \hline 44 \ 0 \ 16 \text{ gross} \end{array} \\
 \qquad \qquad \qquad \begin{array}{r} C. \quad gr. \quad lb. \\ 1 \quad 3 \quad 10 \\ \hline 6 \times 4 = 24 \end{array} \\
 \qquad \qquad \qquad \begin{array}{r} 2 \ 0 \ 16 \text{ tare} \\ \hline \end{array} \\
 \text{Ans. } 42 \ 0 \ 0 \text{ neat weight} \\
 \hline
 \begin{array}{r} 44 \ 0 \ 16 \text{ proof} \\ \hline \end{array}
 \end{array}$$

TARE AND TREW.

75

	<i>b.</i>	<i>c. qr. lb.</i>
(5)	18	1 2 13
	$4 \times 5 = 20$	$5 \times 4 = 20$
	<hr/>	<hr/>
	2 16	8 0 9
	5	4
	<hr/>	<hr/>
Tare	3 0 24	32 1 8 gross
	<hr/>	<hr/>
		3 0 24 tare
		<hr/>
		Ans. 29 0 12 neat weight
		<hr/>
		32 1 8 proof
		<hr/>

CASE II.

	<i>c. qr. lb.</i>
(6)	4 2 6
	6
	<hr/>
14 = $\frac{1}{8}$	27 1 8 gross
	3 1 18 tare
	<hr/>
	23 3 18 neat weight
	<hr/>

lb.	<i>(7)</i>	<i>(8)</i>
16 = $\frac{1}{8}$	<i>c. qr. lb.</i>	<i>c. qr. lb.</i>
	127 3 14 gross	2 1 5
	18 1 2 tare	$6 \times 6 = 36$
	<hr/>	<hr/>
	109 2 12 neat wt.	13 3 2
	<hr/>	6
		<hr/>
lb.		
14 = $\frac{1}{8}$	82 2 12 gross	
7 = $\frac{1}{4}$	10 1 8 $\frac{1}{4}$ } subtract	
	5 0 18 $\frac{1}{4}$	
	<hr/>	
	5 0 18 $\frac{1}{4}$ tare	
	<hr/>	
	77 1 21 $\frac{1}{4}$ neat wt.	
	<hr/>	

(9)				(10)			
C.	gr.	lb.		C.	gr.	lb.	
7	0	0		5	2	4	
		3					$4 \times 4 = 16.$
lb.							
$14 = \frac{1}{8}$	21	0	0 gross	22	0	16	
						4	
$7 = \frac{1}{2}$	2	2	14	lb.			
				$14 = \frac{1}{8}$	88	2	8 gross
$3\frac{1}{2} = \frac{1}{2}$	1	1	7 } add				
	0	2	$17\frac{1}{2}$ }	$7 = \frac{1}{2}$	11	0	8 } add
					5	2	4 }
	1	3	$24\frac{1}{2}$ tare		16	2	12 tare
	19	0	$3\frac{1}{2}$ neat wt.		71	3	24 neat wt.

CASE III.

(11)				(12)			
lb.	C.	qr.	lb.	lb.	C.	qr.	lb.
$28 = \frac{1}{4}$	20	1	4 gross	$14 = \frac{1}{8}$	6	2	24 gross
	<hr/>	<hr/>	,		<hr/>	<hr/>	
$7 = \frac{1}{4}$	5	0	8		0	3	10 tare
	1	1	2		<hr/>	<hr/>	
	<hr/>	<hr/>		26	5	3	14 suttle
	6	1	10 tare		0	0	$25\frac{4}{13}$ tret
	<hr/>	<hr/>			<hr/>	<hr/>	
* 26	13	3	22 suttle		5	2	$16\frac{9}{13}$ neatwt
	0	2	$4\frac{1}{13}$ tret		<hr/>	<hr/>	
	<hr/>	<hr/>					
	13	1	$17\frac{9}{13}$ neat wt.				
	<hr/>	<hr/>					

TARE AND TRET.

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(13)			(14)			
	C.	qr.	lb.	C.	qr.	lb.
b.	9	1	14	4	2	7
			12			8
14 = $\frac{1}{8}$	112	2	0 gross	16 = $\frac{1}{7}$	36	2 0 gross
7 = $\frac{1}{2}$	14	0	7	8 = $\frac{1}{2}$	5	0 24
	7	0	3 $\frac{1}{2}$		2	2 12
	21	0	10 $\frac{1}{2}$ tare		7	3 8 tare
6	91	1	17 $\frac{1}{2}$ suttle	26	28	2 20 suttle
	3	2	1 $\frac{1}{4}$ tret		1	0 11 $\frac{7}{3}$ tret
	87	3	15 $\frac{3}{4}$ neat wt.		27	2 8 $\frac{6}{3}$ neat wt.

(15)			
	C.	qr.	lb.
	2	3	14
			4 × 7 = 28.
	11	2	0
			7
14 = $\frac{1}{8}$	80	2	0 gross
7 = $\frac{1}{2}$	10	0	7
3 $\frac{1}{2}$ = $\frac{1}{2}$	5	0	3 $\frac{1}{2}$
	2	2	1 $\frac{1}{4}$
	17	2	12 $\frac{1}{4}$ tare
26	62	3	15 $\frac{3}{4}$ suttle
	2	1	18 $\frac{3}{4}$ $\frac{11}{16}$ tret
	60	1	24 $\frac{3}{4}$ $\frac{9}{16}$ neat weight.

TARE AND TRET.

CASE IV.

<i>lb.</i>	<i>C. gr. lb.</i>	(16)	<i>lb.</i>	<i>C. gr. lb. oz.</i>	(17)
$14 = \frac{1}{8}$	$92\ 3\ 12$ gross		$16 = \frac{1}{2}$	$64\ 3\ 0\ 0$ gross	
	<hr/>	<hr/>		<hr/>	<hr/>
	4 0 12 tare		8 = $\frac{1}{2}$	9 1 0 0	
	<hr/>	<hr/>		<hr/>	<hr/>
26	28 3 0 suttle			4 2 14 0 tare	
	1 0 11 13 tret			<hr/>	
	<hr/>	<hr/>	26	60 0 14 0 suttle	
*168	27 2 16 3 tret suttle			2 1 7 0 tret	
	0 0 18 6 cloff			<hr/>	
	<hr/>	<hr/>	168	57 3 7 0 tret suttle	
	27 1 25 13 neat wt.			0 1 10 8 $\frac{1}{2}$ cloff	
	<hr/>	<hr/>		<hr/>	<hr/>
				57 1 24 7 $\frac{1}{2}$ neat wt.	

<i>lb.</i>	<i>C. gr. lb.</i>	(18)	<i>lb.</i>	<i>C. gr. lb.</i>	(19)
	12 1 16			9 1 14	
	$6 \times 6 = 36$			6	
	<hr/>	<hr/>		<hr/>	<hr/>
	74 1 12			56 1 0 gross	
	6			5 1 24 tare	
	<hr/>	<hr/>		<hr/>	<hr/>
$14 = \frac{1}{8}$	446 0 16 gross		26	50 3 4 0 suttle	
	<hr/>	<hr/>		1 3 22 12 tret	
				<hr/>	
7 = $\frac{1}{2}$	55 3 2		168	48 3 9 4 tret sutt.	
	27 3 15			6 1 4 8 cloff	
	<hr/>	<hr/>		<hr/>	<hr/>
	83 2 17 tare			48 2 4 12 neat wt.	
	<hr/>	<hr/>			
26	362 1 27 suttle				
	13 3 21 $\frac{1}{2}$ tret				
	<hr/>	<hr/>			
168	348 2 5 $\frac{1}{2}$ tret suttle				
	2 0 8 $\frac{1}{4}$ 1 $\frac{1}{2}$ cloff				
	<hr/>	<hr/>			
	346 1 25 1 $\frac{1}{2}$ neat wt.				

* 2 lb. is the 168th part of 3 cwt. or 336 lb.

SIMPLE INTEREST.

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$\frac{m}{7}$	$\frac{c}{8}$	(20)
16	2	28 2 0 gross
2	4	4 0 8
	0	0 2 1
		4 2 9 tare
26	23	23 3 19 suttle
	0	0 3 19 tret
168	23	23 0 0 tret suttle
	0	0 0 15½ cloff
		22 3 12½ neat wt.

SIMPLE INTEREST.

$$\begin{array}{r}
 \$ \\
 964 \\
 \times 5 \\
 \hline
 18,20 \quad 18\text{l. } 4\text{s. Ans.} \\
 -20 \\
 \hline
 4,00
 \end{array}$$

NOTE. When the rate per cent is an aliquot part, the operation is better performed by Practice, thus in Ex. (1)

$\frac{\$}{5} = \frac{1}{20} \times 364$ at 5 per cent.

$\underline{\$ 18 \quad 4}$ the interest required,

$$\begin{array}{r}
 (2) \quad 364 \times 4\frac{1}{2} \\
 \hline
 -100 \\
 \hline
 = 16l. 7s. 7\frac{1}{2}d.
 \end{array}$$

SIMPLE INTEREST.

$$(3) \quad \frac{364 \times 4}{100} = 14l. 11s. 2\frac{1}{4}\frac{1}{2}d$$

$$(4) \quad \begin{array}{r} \cancel{\text{£}} \\ 5 = \frac{1}{20}) 500 \end{array} \begin{array}{r} \cancel{\text{£}} \quad s. \quad d. \\ 10 \quad 6\frac{1}{4} \\ \hline \cancel{\text{£}} \quad 25 \quad 0 \quad 6\frac{1}{4}\frac{1}{4} \end{array}$$

$$(5) \quad \frac{\cancel{\text{£}} \quad 16 \quad \frac{d.}{8} \times 4\frac{1}{2}}{100} = 38l. 16s. 6\frac{1}{2}\frac{1}{2}d.$$

$$(6) \quad \begin{array}{r} \cancel{\text{£}} \\ 4 = \frac{1}{25}) 1000 \end{array} \begin{array}{r} \cancel{\text{£}} \quad s. \quad d. \\ 16 \quad 8 \\ \hline \cancel{\text{£}} \quad 40 \quad 0 \quad 8 \end{array}$$

(7) First, $5 \times 5 = 25$ product of the rate and time;
then, $25 = \frac{1}{4} \times 486$

$$\begin{array}{r} \cancel{\text{£}} \quad 121 \quad 10 \\ \hline \end{array}$$

$$(8) \quad \begin{array}{r} \cancel{\text{£}} \\ 5 = \frac{1}{20}) 884 \end{array} \begin{array}{r} \cancel{\text{£}} \\ 44 \quad 4 \text{ interest for 1 year} \\ 7 \\ \hline \end{array}$$

$$\begin{array}{r} \cancel{\text{£}} \\ 309 \quad 8 \text{ do. for 7 years} \\ 884 \quad 0 \text{ principal} \\ \hline \end{array}$$

$$\begin{array}{r} \cancel{\text{£}} \quad 1193 \quad 8 \text{ the amount.} \\ \hline \end{array}$$

$$(9) \quad \frac{1001 \times 4\frac{1}{2} \times 6}{100} = \begin{array}{r} \cancel{\text{£}} \quad s. \quad d. \\ 270 \quad 5 \quad 4\frac{1}{2} \text{ interest} \\ 1001 \quad 0 \quad 0 \text{ principal} \\ \hline \end{array}$$

$$\begin{array}{r} \cancel{\text{£}} \quad 1271 \quad 5 \quad 4\frac{1}{2} \text{ amount} \\ \hline \end{array}$$

SIMPLE INTEREST.

g1

$$\begin{array}{r}
 (10) \quad \frac{460 \times 3\frac{3}{4}}{100} = 17 \frac{5}{4} \text{ interest for 1 year} \\
 \\
 \begin{array}{r}
 69 \quad 0 \text{ do. for 4 years} \\
 460 \quad 0 \text{ principal} \\
 \hline
 \end{array} \\
 \\
 \begin{array}{r}
 \mathcal{L} \quad 529 \quad 0 \text{ amount.}
 \end{array}
 \end{array}$$

$$(11) \quad \begin{array}{c|c} \frac{\mathcal{L}}{5} = \frac{1}{20} & \frac{\mathcal{L}}{924} \\ \text{mo.} & \hline 2 = \frac{1}{6} & 4 \text{ interest for 1 year} \\ & \hline & \mathcal{L} 7 \frac{1}{14} \text{ interest for 2 months.} \end{array}$$

$$(12) \quad \begin{array}{c|c} \mathcal{L} & \mathcal{L} \\ 4 = \frac{1}{25} & | 1205 \\ \hline mo. & 6 = \frac{1}{2} & | 48 \quad 4 \text{ interest for 1 year.} \\ \hline & & \mathcal{L} \quad 24 \quad 2 \text{ interest for } \frac{1}{2} \text{ year.} \end{array}$$

(13)	$\frac{\mathcal{L}}{5} = \frac{1}{20}$	$\frac{\mathcal{L}}{640}$	s.	d.
			32	0
			5	interest for 1 year
			7	
			224	2 11 interest for 7 years
			640	8 4 principal
			864	11 3 amount.

SIMPLE INTEREST.

(14)	$\frac{5}{5} = \frac{1}{20}$	$\frac{\pounds}{\text{s.}} \quad \frac{\text{s.}}{\text{d.}}$	9640 16 8
	mo.		
	$6 = \frac{1}{2}$		482 0 10 interest for 1 year
			4
			1928 3 4 interest for 4 years
	3 = $\frac{1}{2}$		241 0 5 interest for 6 months
			120 10 2 $\frac{1}{2}$ interest for 3 months
			2289 13 11 $\frac{1}{2}$ interest for 4 yrs. 9 mo.
			9640 16 8 principal
			\pounds 11930 10 7 $\frac{1}{2}$ amount.

(15)	$\frac{5}{5} = \frac{1}{20}$	$\frac{\pounds}{\text{s.}} \quad \frac{\text{s.}}{\text{d.}}$	20 0
	wks.		
	$18 = \frac{1}{4}$		1 0 interest for 1 year
			0 5 interest for 18 weeks
			20 0 principal
			\pounds 20 5 amount.

(16)	$\frac{5}{5} = \frac{1}{20}$	$\frac{\pounds}{\text{s.}}$	500
			\pounds 25 interest for 1 year;
then,	52 wks.	:	25l. :: 39 wks. : 18l. 15s.
and	$25 \times 4 = 100$	$\frac{\pounds}{\text{s.}}$	0 interest for 4 years
			18 15 interest for 39 weeks
			500 0 principal
			\pounds 618 15 amount.

COMMISSION.

83

$$(17) \quad 5 = \frac{1}{20} | \frac{\mathcal{L}}{641} \overline{32} \quad \mathcal{L} \ 32 \text{ interest for 1 year;}$$

then, 365 days : 32*l.* 1*s.* :: 50 days : 4*l.* 7*s.* 9*1\over2\frac{1}{2}\frac{1}{2}**d.*

$$(18) \quad \frac{2000 \times 4\frac{1}{2}}{100} = 90 \text{ interest for 1 year;}$$

then, 365 days : 90*l.* :: 63 days : 15*l.* 10*s.* 8*1\frac{1}{2}\frac{1}{2}**d.*

$$(19) \quad 4 = \frac{1}{25} | \frac{\mathcal{L}}{5800} \overline{16} \quad \mathcal{L} \ 232 \ 0 \ 3 \text{ interest for 1 year;}$$

then, 365 days : 232*l.* 0*s.* 3*d.* :: 260 days : 165*l.* 5*s.* 8*1\frac{1}{2}\frac{1}{2}**d.* interest; and, 5800*l.* 16*s.* 8*d.* + 165*l.* 5*s.* 8*1\frac{1}{2}\frac{1}{2}**d.* = 5966*l.* 2*s.* 4*1\frac{1}{2}\frac{1}{2}**d.* amount.

$$(20) \quad 5 = \frac{1}{20} | \frac{\mathcal{L}}{563} \overline{12} \quad \mathcal{L} \ 23 \ 3 \ 7\frac{1}{2} \ 1\frac{1}{2} \text{ interest for 1 year;}$$

then, 365 days : 23*l.* 3*s.* 7*1\frac{1}{2}\frac{1}{2}**d.* :: 265 days : 20*l.* 9*s.* 2*1\frac{1}{2}\frac{1}{2}**d.*

COMMISSION.

$$(1) \quad 2\frac{1}{2} = \frac{1}{40} | \frac{\mathcal{L}}{500} \overline{12} \ 10$$

$$(2) \quad 2 = \frac{1}{50} | \frac{\mathcal{L}}{369} \overline{7} \ 7 \ 7\frac{1}{2}$$

BROKAGE.

$$(3) \quad \frac{\text{£} \ s. \ d.}{748 \ 11 \ 8 \times 3} = 22l. 9s. 1\frac{1}{4}d.$$

$\underline{100}$

$$(4) \quad \frac{1900 \times 5\frac{1}{2}}{100} = 111l. 12s. 6d.$$

—————

BROKAGE.

$$(1) \quad \begin{array}{r|rr} \text{£} & 640 \\ \hline \text{s.} & \text{£} \\ 5 = \frac{1}{4} & \hline & 6 \ 8 \text{ at 1 per cent.} \\ \hline & \text{£} \ 1 \ 12 \text{ at 5s. per cent.} \end{array}$$

$$(2) \quad \begin{array}{r|rr} \text{£} & 845 \\ \hline \text{s.} & \text{£} \\ 10 = \frac{1}{2} & \hline & 8 \ 9 \text{ at 1 per cent.} \\ \hline & \text{£} \ 4 \ 4 \ 6 \text{ at 10s. per cent.} \end{array}$$

$$(3) \quad 2\frac{1}{2} = \frac{1}{40} \mid \begin{array}{r|rr} \text{£} & \text{s.} & \text{d.} \\ 202 & 1 & 8 \\ \hline & 5 & 1 & 0\frac{1}{2} \end{array}$$

$$(4) \quad \frac{\text{£} \ s. \ d.}{4360 \ 8 \ 4 \times 3} = 130l. 16s. 3d.$$

$\underline{100}$

$$(5) \quad \frac{240 \ 16 \ 8 \times 3\frac{1}{2}}{100} = 7l. 16s. 6\frac{1}{2}d.$$

INSURANCE

$$(1) \quad \begin{array}{r} \text{£} \\ 10 = \frac{1}{10} \end{array} \mid \begin{array}{r} \text{£} \\ 4680 \\ \hline 468 \\ 23 \quad 8 \\ \hline \text{£} \quad 491 \quad 8 \end{array}$$

$$(2) \quad \begin{array}{r} \text{£} \\ 10 = \frac{1}{10} \end{array} \mid \begin{array}{r} \text{£} \\ 9000 \\ \hline 900 \\ 45 \\ 22 \quad 10 \\ \hline 967 \quad 10 \end{array}$$

$$(3) \quad \begin{array}{r} \text{£} \\ 10 = \frac{1}{10} \end{array} \mid \begin{array}{r} \text{£} \quad s. \\ 782 \quad 10 \\ \hline 78 \quad 5 \\ 39 \quad 2 \quad 6 \\ 3 \quad 18 \quad 3 \\ \hline \text{£} \quad 121 \quad 5 \quad 9 \end{array}$$

$$(4) \quad \frac{780 \times 5\frac{1}{2}}{100} = 41l. 18s. 6d.$$

$$(5) \quad \frac{1500 \times 6\frac{1}{2}}{100} = 97l. 10s.$$

DISCOUNT.

PURCHASING STOCKS.

Example (1) is worked.

$$(2) \quad 20 = \frac{1}{5} | \begin{array}{r} \text{£} & s. & d. \\ 640 & 8 & 0 \text{ at } 100 \text{ per cent.} \\ 128 & 1 & 7\frac{1}{2} \text{ at } 20 \text{ per cent.} \\ \hline \text{£} & 768 & 9 & 7\frac{1}{2} \end{array}$$

$$(3) \quad \begin{array}{r} \text{£} & s. & d. \\ 20 = \frac{1}{5} | \begin{array}{r} \text{£} & s. & d. \\ 926 & 0 & 0 \text{ at } 100 \text{ per cent.} \\ 185 & 4 & 0 \text{ at } 20 \text{ per cent.} \\ \frac{1}{2} = \frac{1}{20} | \begin{array}{r} \text{£} & s. & d. \\ .92 & 12 & 0 \text{ at } 10 \text{ per cent.} \\ .4 & 12 & 7\frac{1}{2} \text{ at } \frac{1}{2} \text{ per cent.} \\ \hline \text{£} & 1208 & 8 & 7\frac{1}{2} \end{array} \end{array} \end{array}$$

$$(4) \quad \frac{1752 \times 115\frac{1}{2}}{100} = 2025l. 15s.$$

$$(5) \quad \frac{1200 \times 84\frac{1}{2}}{100} = 1009l. 10s.$$

$$(6) \quad \text{First, } 90\frac{1}{8} + \frac{1}{8} = 90\frac{1}{2} \\ \text{then, } \frac{1300 \times 90\frac{1}{2}}{100} = 1176l. 10s.$$

DISCOUNT.

Example (1) is worked.

$$(2) \quad 5 = \frac{1}{20} | \begin{array}{r} \text{£} \\ 100 \\ \hline \text{£} \end{array} \quad \text{5 interest of 100 for 12 months,}$$

then, $105l. : 5l. :: 50l. : 2l. 7s. 7\frac{1}{4}d. 75$ remain.

DISCOUNT.

87

(3) $105l. : 100l. :: 200l. : 190l. 9s. 6\frac{1}{4}d. 15$
remain.

$$(4) \begin{array}{r} \text{mths.} \\ 3 = \frac{1}{4} | \quad \frac{\mathcal{L}}{5} \\ \hline 1 & 5 \text{ interest} \\ 100 \\ \hline 101 & 5 \text{ amount;} \end{array}$$

then, $101l. 5s. : 1l. 5s. :: 36l. : 35l. 11s. 1\frac{1}{4}d.$
 1350 remain.

$$(5) \begin{array}{r} \frac{\mathcal{L}}{4} \times 3 = \frac{\mathcal{L}}{13} \frac{s.}{10} \text{ interest} \\ 100 \quad 0 \text{ principal} \\ \hline 113 & 10 \text{ amount;} \end{array}$$

then, $113l. 10s. : 13l. 10s. :: 578l. 16s. : 68l.$
 $4s. 11\frac{1}{4}d. 83$ remain.

$$(6) \begin{array}{r} \frac{\mathcal{L}}{4} \frac{s.}{7} \frac{d.}{6} \text{ interest for 1 year} \\ 2 \quad 3 \text{ interest for 6 months} \\ 1 \quad 1 \frac{1}{2} \text{ interest for 3 months} \\ 100 \quad 0 \text{ principal} \\ \hline 107 & 13 \frac{1}{2} \text{ amount;} \end{array}$$

then, $107l. 13s. 1\frac{1}{2}d. : 100l. :: 130l. : 120l.$
 $15s. 1d. 546$ remain.

$$(7) \begin{array}{r} \frac{\text{days}}{73} = \frac{1}{5} | \quad \frac{\mathcal{L}}{5} \\ \hline 1 \text{ interest for 73 days} \\ 100 \text{ principal} \\ \hline 101 \text{ amount;} \end{array}$$

then, $101l. : 1l. :: 399l. 18s. 4d. : 3l. 19s.$
 $1\frac{1}{2} \frac{8}{10} d.$ discount.
and, $399l. 18s. 4d. - 3l. 19s. 1\frac{1}{2} \frac{8}{10} d. = 395l. 14s.$
 $2\frac{1}{4} \frac{18}{10} d.$ the present worth.

COMPOUND INTEREST.

		$\frac{\mathcal{L}}{s.} \quad s. \quad d.$
(1)	$5 = \frac{1}{20}$	$50 \quad 0 \quad 0$ $2 \quad 10 \quad 0$ 1st year's interest -----
		$52 \quad 10 \quad 0$ amount $2 \quad 12 \quad 6$ 2d year's interest -----
	$5 = \frac{1}{20}$	$55 \quad 2 \quad 6$ amount $2 \quad 15 \quad 1\frac{1}{2}$ 3d year's interest -----
		$\mathcal{L} \quad 57 \quad 17 \quad 7\frac{1}{2}$ amount. -----

		$\frac{\mathcal{L}}{s.} \quad s. \quad d.$
(2)	$\frac{1}{20}$	$100 \quad 0 \quad 0$ principal $5 \quad 0 \quad 0$ 1st year's interest -----
	$\frac{1}{20}$	$105 \quad 0 \quad 0$ 2d year's principal $5 \quad 5 \quad 0$ interest -----
	$\frac{1}{20}$	$110 \quad 5 \quad 0$ 3d year's principal $5 \quad 10 \quad 3$ interest -----
	$\frac{1}{20}$	$115 \quad 15 \quad 3$ 4th year's principal $5 \quad 15 \quad 9\frac{3}{20}$ interest -----
		$\mathcal{L} \quad 121 \quad 11 \quad 0\frac{3}{20}$ amount. -----

COMPOUND INTEREST.

89

per cent.				(3)
5 $\frac{1}{2}$	\pounds	s.	d.	
	100	0	0	principal
$\frac{1}{2}$	5	0	0	
	2	10	0	
	100	0	0	
20	10 $\frac{1}{2}$	10	0	the 1st half year's amount
$\frac{1}{2}$	5	2	6	
	2	11	5	
	102	10	0	
20	105	1	3	the 2d half year's amount
$\frac{1}{2}$	5	5	0 $\frac{1}{4}$	
	2	12	0 $\frac{1}{4}$	
	105	1	5	
20	107	13	9 $\frac{1}{4}$	the 3d half year's amount
$\frac{1}{2}$	5	7	8 $\frac{1}{4}$	
	2	13	10	
	107	13	9 $\frac{1}{4}$	
20	110	7	7 $\frac{1}{4}$	the 4th half year's amount
$\frac{1}{2}$	5	10	4 $\frac{1}{4}$	
	2	15	2 $\frac{1}{4}$	
	110	7	7 $\frac{1}{4}$	
20	113	2	9 $\frac{1}{4}$	the 5th half year's amount
$\frac{1}{2}$	5	13	1 $\frac{1}{4}$	
	2	16	6 $\frac{3}{4}$	
	113	2	9 $\frac{1}{4}$	
20	115	19	4 $\frac{1}{4}$	the 6th half year's amount
$\frac{1}{2}$	5	15	11 $\frac{1}{4}$	
	2	17	11 $\frac{1}{4}$	
	115	19	4 $\frac{1}{4}$	
20	118	17	4	the 7th half year's amount
$\frac{1}{2}$	5	18	10 $\frac{1}{4}$	
	2	19	5	
	118	17	4	
\pounds	121	16	9	the 8th half year's amount.

COMPOUND INTEREST.

$\frac{\mathcal{L}}{5} = \frac{1}{25}$	$\frac{\mathcal{L}}{5}$	s.	d.	(4)
	100	0	0	principal
$\frac{1}{4}$	5	0	0	
$\frac{1}{4}$	1	5	0	
	100	0	0	
$\frac{1}{4}$	101	5	0	the 1st quarter's amount
$\frac{1}{4}$	5	1	3	
$\frac{1}{4}$	1	5	$5\frac{1}{4}$	
	101	5	0	
$\frac{1}{4}$	102	10	$5\frac{1}{4}$	the 2d quarter's amount
$\frac{1}{4}$	5	2	6	
$\frac{1}{4}$	1	5	$7\frac{1}{4}$	
	102	10	$5\frac{1}{4}$	
$\frac{1}{4}$	105	15	$11\frac{1}{4}$	the 5d quarter's amount
$\frac{1}{4}$	5	5	$9\frac{1}{4}$	
$\frac{1}{4}$	1	5	$11\frac{1}{4}$	
	105	15	$11\frac{1}{4}$	
$\frac{1}{4}$	105	1	$10\frac{1}{4}$	the 4th quarter's amount
$\frac{1}{4}$	5	5	1	
$\frac{1}{4}$	1	6	$5\frac{1}{4}$	
	105	1	$10\frac{1}{4}$	
$\frac{1}{4}$	106	8	$1\frac{1}{4}$	the 5th quarter's amount
$\frac{1}{4}$	5	6	$4\frac{3}{4}$	
$\frac{1}{4}$	1	6	7	
	106	8	$1\frac{1}{4}$	
$\frac{1}{4}$	107	14	$8\frac{1}{4}$	the 6th quarter's amount
$\frac{1}{4}$	5	7	$8\frac{1}{4}$	
$\frac{1}{4}$	1	6	11	
	107	14	$8\frac{1}{4}$	
$\frac{1}{4}$	109	1	$7\frac{1}{4}$	the 7th quarter's amount
$\frac{1}{4}$	5	9	$1\frac{3}{4}$	
$\frac{1}{4}$	1	7	3	
	109	1	$7\frac{1}{4}$	
$\frac{1}{4}$	110	8	$10\frac{1}{4}$	the 8th quarter's amount.

COMPOUND INTEREST.

91

£	(5)	£	s.	d.
450		468	0	0
4		18	14	4 $\frac{1}{4}$
<hr/>		<hr/>	<hr/>	<hr/>
18 00		486	14	4 $\frac{1}{4}$
450		<hr/>	<hr/>	<hr/>
468	1st year's amt.	19 46	17	7
4		20		
<hr/>		<hr/>	<hr/>	<hr/>
18 72		9 37		
20		12		
<hr/>		<hr/>	<hr/>	<hr/>
14 40		4 51		
12		4		
<hr/>		<hr/>	<hr/>	<hr/>
4 80		2 04		
4		<hr/>	<hr/>	<hr/>
<hr/>		<hr/>	<hr/>	<hr/>
3 20				
486	14	4 $\frac{1}{4}$		
19	9	4 $\frac{1}{4}$		
<hr/>		<hr/>	<hr/>	<hr/>
506	3	9 $\frac{1}{4}$	3d year's amt.	
4		<hr/>		
526	8	8 $\frac{1}{2}$	4th year's amt.	
<hr/>		<hr/>		
20 24	15	1		
20		20		
<hr/>		<hr/>	<hr/>	<hr/>
4 95		1 14		
12		12		
<hr/>		<hr/>	<hr/>	<hr/>
11 41		1 78		
4		4		
<hr/>		<hr/>	<hr/>	<hr/>
1 64		3 12		
<hr/>		<hr/>	<hr/>	<hr/>
526	8	8 $\frac{1}{2}$		
21	1	1 $\frac{1}{4}$		
<hr/>		<hr/>		
547	9	10 $\frac{1}{4}$	5th year's amt.	
450	0	0	principal	
<hr/>		<hr/>		
£	97	9	10 $\frac{1}{4}$	compound int.

EQUATION OF PAYMENTS.

$$\begin{array}{rcc}
 & (1) & (2) \\
 \begin{array}{r} \text{\pounds} \\ 100 \\ 4 \\ \hline 400 \end{array} & \begin{array}{r} \text{\pounds} \\ 100 \\ 6 \\ \hline 600 \\ 400 \\ \hline 2|00)10|00 \\ \hline 5 \text{ months.} \end{array} & \begin{array}{r} \text{\pounds} \quad \text{mo.} \\ 200 \times 0 = 200 \\ 600 \times 4 = 2400 \\ 200 \times 6 = 1200 \\ \hline 1000)3|800 \\ \hline 3\frac{1}{3} \text{ months.} \end{array}
 \end{array}$$

$$\begin{array}{rcc}
 & (3) & (4) \\
 \begin{array}{r} \text{\pounds} \quad \text{mo.} \\ 100 \times 2 = 200 \\ 80 \times 5 = 400 \\ 60 \times 7 = 420 \\ \hline 24|0 \end{array} & \begin{array}{r} \text{\pounds} \\ 6|102|0 \\ \hline 4) 17 \\ \hline 4\frac{1}{4} \text{ months.} \end{array} & \begin{array}{r} \text{\pounds} \quad \text{mo.} \\ 100 \times 2 = 200 \\ 200 \times 4 = 800 \\ 300 \times 6 = 1800 \\ 100 \times 12 = 1200 \\ \hline 7|00 \end{array} & \begin{array}{r} \text{\pounds} \\)40|00 \\ \hline 5\frac{1}{2} \text{ months.} \end{array}
 \end{array}$$

$$\begin{array}{rcc}
 & (5) & (6) \\
 \begin{array}{r} \text{\pounds} \quad \text{mo.} \\ 100 \times 4 = 400 \\ 200 \times 5 = 1000 \\ 600 \times 12 = 7200 \\ \hline 9|00 \end{array} & \begin{array}{r} \text{\pounds} \\)86|00 \\ \hline 9\frac{1}{2} \text{ months.} \end{array} & \begin{array}{r} \text{\pounds} \\ 3)1200 \\ \hline 400 \times 3 = 1200 \\ 400 \times 4 = 1600 \\ 400 \times 8 = 3200 \\ \hline 12|00 \end{array} & \begin{array}{r} \text{\pounds} \\)60|00 \\ \hline 5 \text{ months.} \end{array}
 \end{array}$$

BARTER.

Example (1) is worked.

$$(2) \quad \begin{array}{r} d. \qquad lb. \\ 6 = \frac{1}{2} | 120 \text{ at } 6d. \\ \hline 20 \qquad 60 \\ \hline \end{array}$$

\mathcal{L} 3 value of the raisins;

then, 2s. : 1 lb. :: 3l. : 30 lb.

$$(3) \quad \begin{array}{r} Cwt. \qquad lb. \\ 2 = 224 \\ 224 \times 2 = 448 \\ \hline 8 \qquad 8 \end{array}$$

then, $\frac{448}{8} = \frac{56}{8} = 56 \text{ lb}$

$$(4) \quad \begin{array}{r} 56 \times 8 = 448 \\ \hline 2 \qquad 2 \end{array} = 224 \text{ lb.} = 2 \text{ cwt.}$$

$$(5) \quad \begin{array}{r} 5 = \frac{1}{2} | 252 \text{ yards at } 5s. \\ \hline \end{array}$$

 \mathcal{L} 63 value of the cloth;

then, 6 hhds. : 63l. :: 1 gal. : 3s. 4d.

(6) First, 1 gall. : 3s. 4d. :: 6 hhds. : 63l. value
of the wine; then, 252 yds. : 63l. :: 1 yd. : 5s.

(7) 8s. 4d. : 10s. :: 20d. : 2s. per lb.

(8) 20d. : 2s. :: 8s. 4d. : 10s. per yd.

$$(9) \quad \begin{array}{r} Cwt. \\ 10 = \frac{1}{2} | 82 \text{ at } 30s. \\ \hline 41 \end{array}$$

123 value of the cheese
20 ready money \mathcal{L} 103 value of B's raisins;

then, 5d. : 1 lb. :: 103l. : 4944 lb. = 44 cwt. 16 lb.

LOSS AND GAIN.

(10) 44 cwt. 16 lb.=4944 lb. at 5d. per lb.=103*l.*
 value of B's raisins ; then, $103l. + 20l. = 123l.$ value of A's
 cheese ; therefore, 30s. : 1 cwt. :: 123*l.* : 82 cwt.
 of cheese A must give B.

LOSS AND GAIN.

Example (1) is worked.

(2) 100*l.* : 110*l.* :: 30s. : 33s.=1*l.* 13*s.* per cwt.

$$(3) \begin{array}{r} \text{\pounds} \quad \text{s.} \quad \text{d.} \\ 10 = \frac{1}{10} | 1 \ 13 \ 0 \\ \underline{-} \qquad \qquad \qquad 3 \ 3\frac{3}{5} \text{ subtract} \\ \hline \text{\pounds} \ 1 \ 9 \ 8\frac{3}{5} \text{ per cwt.} \end{array}$$

(4) 100*l.* : (100*l.*—15*l.*)=85*l.* :: 6s. 8d. : 5s. 8d.

(5) 100*l.* : 115*l.* :: 6s. 8d. : 7s. 8d.

(6) First, 100*l.* : 110*l.* :: 10*l.* 10s. : 11*l.* 11s.
 advanced price of the tobacco per cwt. ; then, 112 lb. :
 11*l.* 11s. :: 1 lb. : 2s. 0*d.*

(7) First, 112 lb. at 2s. 0*d.* per lb.=11*l.* 11s. ; then,
 $10l. 10s. : 11l. 11s. :: 100l. : 110l.$, hence $110l. - 100l. = 10l.$ gain per cent.

(8) 5s. : (6s. 6d.—5s.)=1s. 6d. :: 100*l.* : 30*l.*
 gain per cent.

$$(9) \begin{array}{r} \text{s.} \quad \text{d.} \quad \text{\pounds} \quad \text{\pounds} \\ 2 \ 6 = \frac{1}{5} | 100 \\ \hline \text{\pounds} \ 12 \ 10 \text{ or } 12\frac{1}{2} \text{ per cent.} \end{array}$$

SINGLE FELLOWSHIP.

Example (1) is worked.

$$(2) \quad 300 + 700 = 1000 \text{ sum of the stocks;}$$

$$\text{then, } 1000\text{l.} : 160\text{l.} :: \begin{array}{r} \text{£} \\ 300 \\ 700 \end{array} : \begin{array}{r} \text{£} \\ 48 \\ 112 \end{array} \begin{array}{l} \text{A's share} \\ \text{B's share} \end{array}$$

$$\underline{\text{£}} \quad \underline{\underline{160}} \text{ proof.}$$

$$(3) \quad 460\text{l.} + 760\text{l.} = 1220\text{l. whole stock;}$$

$$\text{then, } 1220\text{l.} : 250\text{l.} :: \begin{array}{r} \text{£} \\ 460 \\ 760 \end{array} : \begin{array}{r} \text{£} \\ 94 \\ 155 \end{array} \begin{array}{r} \text{s.} \\ 5 \\ 14 \end{array} \begin{array}{r} \text{d.} \\ 2\frac{1}{4} \\ 9 \end{array} \begin{array}{l} 980 \text{ A's share} \\ 240 \text{ B's share} \end{array}$$

$$\underline{\text{£}} \quad \underline{\underline{250}} \quad \underline{\underline{0}} \quad \underline{\underline{0}} \text{ proof.}$$

$$(4) \quad 50 + 60 + 70 = 180\text{l. whole stock;}$$

$$\text{then, } 180\text{l.} : 40\text{l.} :: \begin{array}{r} \text{£} \\ 50 \\ 60 \\ 70 \end{array} : \begin{array}{r} \text{£} \\ 11 \\ 13 \\ 15 \end{array} \begin{array}{r} \text{s.} \\ 2 \\ 6 \\ 11 \end{array} \begin{array}{r} \text{d.} \\ 2\frac{1}{2} \\ 8 \\ 1\frac{1}{4} \end{array} \begin{array}{l} \text{A's share} \\ \text{B's share} \\ \text{C's share} \end{array}$$

$$\underline{\text{£}} \quad \underline{\underline{40}} \quad \underline{\underline{0}} \quad \underline{\underline{0}} \text{ proof.}$$

$$(5) \quad 120 + 140 + 200 + 260 = 720\text{l. whole amount.}$$

$$\text{then, } 720\text{l.} : 340\text{l.} :: \begin{array}{r} \text{£} \\ 120 \\ 140 \\ 200 \\ 260 \end{array} : \begin{array}{r} \text{£} \\ 56 \\ 66 \\ 94 \\ 122 \end{array} \begin{array}{r} \text{s.} \\ 13 \\ 2 \\ 8 \\ 15 \end{array} \begin{array}{r} \text{d.} \\ 4 \\ 2\frac{1}{2} \\ 10\frac{1}{2} \\ 6\frac{1}{2} \end{array} \begin{array}{l} \text{A's debt} \\ \text{B's debt} \\ \text{C's debt} \\ \text{D's debt} \end{array}$$

$$\underline{\text{£}} \quad \underline{\underline{340}} \quad \underline{\underline{0}} \quad \underline{\underline{0}} \text{ proof.}$$

SINGLE FELLOWSHIP.

(6) $1620\text{l. } 4\text{s. } 2\text{d.} + 2500\text{l. } 2\text{s. } 6\text{d.} + 4342\text{l. } 1\text{s. } 4\text{d.} + 4298\text{l. } 10\text{s. } 8\text{d.} = 12760\text{l. } 18\text{s. } 8\text{d.}$ whole stock;

then,	$\frac{\text{£}}{\text{s. d.}}$	$\frac{\text{£}}{\text{s. d.}}$
	1620 4 2	253 18 $7\frac{1}{4}$ $\frac{834400}{3062624}$
	2500 2 6	391 16 $9\frac{1}{2}$ $\frac{2580416}{3062624}$
	4342 1 4	680 10 $5\frac{1}{4}$ $\frac{2872928}{3062624}$
	4298 10 8	673 14 $0\frac{1}{4}$ $\frac{2900128}{3062624}$

$\text{£ } 2000 \ 0 \ 0$ proof.

(7)	$\frac{\text{£}}{\text{1/3}}$	$\frac{\text{£}}{\text{760}}$
First,	$\left\{ \begin{array}{l} \frac{1}{3} \\ \frac{1}{4} \\ \frac{1}{5} \\ \frac{1}{6} \end{array} \right.$	$\left\{ \begin{array}{l} 570 \\ 456 \\ 380 \end{array} \right.$
		<hr/>
		$\text{£ } 2166$ sum of the parts
		<hr/>

then, 2166 $\text{l.} : 2280\text{l.} ::$	$\frac{\text{£}}{760}$	$\frac{\text{£}}{800}$ A's part
	570	600 B's part
	456	480 C's part
	380	400 D's part

$\text{£ } 2280$ proof.

(8) $45 + 60 + 64 + 72 + 80 = 321$ men in all;

then, 321 : 24075 ::	$\frac{\text{men.}}{\text{£}}$	$\frac{\text{£}}{\text{3375}}$ 1st party's share
	60	4500 2d party's share
	64	4800 3d party's share
	72	5400 4th party's share
	80	6000 5th party's share.

DOUBLE FELLOWSHIP.

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DOUBLE FELLOWSHIP.

Example (1) is worked.

$$(2) \quad \mathcal{L} \ 120 \times 4 = 480$$

$$230 \times 3 = 690$$

$$360 \times 2 = 720$$

$$\mathcal{L} \ 1890$$

	\mathcal{L}	\mathcal{L}	s.	d.	
then,	480	30	9	6 $\frac{1}{2}$	A's share
1890 \mathcal{L} : 120 \mathcal{L} :: 690 : 43 16 2 $\frac{1}{2}$					B's share
	720	45	14	3 $\frac{1}{2}$	C's share

$$\mathcal{L} \ 120 \ 0 \ 0 \text{ proof}$$

$$(3) \quad 12 \times 6 = 72$$

$$14 \times 8 = 112$$

$$10 \times 16 = 160$$

$$12 \times 20 = 240$$

$$\mathcal{L} \ 584$$

	\mathcal{L}	\mathcal{L}	s.	d.	
then, 584 \mathcal{L} : 14 \mathcal{L} :: 72 : 1 14 6 $\frac{1}{2}$					A's share
	112	2	13	8 $\frac{1}{2}$	B's share
	160	3	16	8 $\frac{1}{2}$	C's share
	240	5	15	0 $\frac{1}{2}$	D's share

$$\mathcal{L} \ 14 \ 0 \ 0 \text{ proof}$$

	\mathcal{L}	mo.	\mathcal{L}	mo.	products.
(4) First,	100	8	100	8	= A's product
	80	5	100	3	+ = B's product
	176	4	136	4	+ = C's product
	230	6	1380	6	+ = D's product

$$\mathcal{L} \ 4128 = \text{sum of the products}$$

		<i>£</i>	<i>s.</i>	<i>d.</i>	
then,	800	38	15	$21\frac{1}{4}\frac{1}{2}\frac{1}{2}$	A's share
4128 : 1248 :: 200 :	700	33	18	$3\frac{1}{2}\frac{5}{7}\frac{6}{5}$	B's share
	1380	60	9	$3\frac{1}{2}\frac{1}{2}\frac{1}{2}$	C's share
		66	17	$21\frac{1}{2}\frac{1}{2}\frac{1}{2}$	D's share.

$$(5) \quad \text{First, } \frac{200}{8} = 25; \frac{168}{12} = 14; \frac{240}{6} = 40$$

then, $25 + 14 + 40 = 79$ sum of their gains,

			£	s.	d.	
	25	632	18	2	14	A's stock
and, 79 : 2000 :: 14 :	354	8	7	14	14	B's stock
	40	1012	13	1	14	C's stock

ALLIGATION MEDIAL.

(1)

Bush.	s.	s.
$16 \times 6 = 96$		
$8 \times 4 = 32$		
<hr/>	s. d.	
24) 128(5 4 Ans.	5	4
120		
<hr/>		
..8	1	1
<hr/>		4
12		6
<hr/>		
24) 96(4d.	£ 6	8 0 = 128s. proof*
96	<hr/>	

- These examples are proved by Alligation Alternate; but may be proved by finding the value of the whole mixture at the mean price, which must be equal to the total value of the several ingredients, as in Example 1.

ALLIGATION ALTERNATE.

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$$\begin{array}{r}
 (2) \\
 \begin{array}{r}
 \text{lb.} \quad s. \\
 2 \times 4 = 8 \\
 2 \times 5 = 10 \\
 3 \times 8 = 24 \\
 \hline
 7) \quad 42 \\
 \hline
 \end{array}
 \end{array}$$

6s. per lb.

$$\begin{array}{r}
 (3) \\
 \begin{array}{r}
 \text{gal.} \quad \text{s.} \quad \text{d.} \quad \text{s.} \\
 36 \times 6 \quad 6 = 234 \\
 12 \times 5 \quad 0 = 60 \\
 12 \times 3 \quad 0 = 36 \\
 \hline
 60 \quad 6 | 0) 33 | 0 \\
 \hline
 \end{array}
 \end{array}$$

5 6d. per gal.

$$\begin{array}{r}
 (4) \\
 \begin{array}{r}
 \text{lb.} \quad \text{C.} \quad \text{C.} \\
 3 \times 18 = 54 \\
 1 \times 20 = 20 \\
 1 \times 22 = 22 \\
 3 \times 24 = 72 \\
 \hline
 8) \quad 168 \\
 \hline
 \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 (5) \\
 \begin{array}{r}
 \text{bu.} \quad \text{s.} \quad \text{d.} \quad \text{s.} \\
 12 \times 6 \quad 0 = 72 \\
 6 \times 5 \quad 0 = 30 \\
 6 \times 4 \quad 6 = 27 \\
 18 \times 3 \quad 6 = 63 \\
 24 \times 3 \quad 0 = 72 \\
 \hline
 66) \quad 264(4s. \quad 24) \\
 \hline
 \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 (6) \\
 \begin{array}{r}
 \text{gal.} \quad \text{d.} \quad \text{d.} \\
 4 \times 16 = 64 \\
 4 \times 12 = 48 \\
 3 \times 9 = 27 \\
 1 \times 5 = 5 \\
 12 \times 4 = 48 \\
 \hline
 192(8d. \\
 \hline
 \end{array}
 \end{array}$$

Ans. 21 caracts
fine

ALLIGATION ALTERNATE.

$$\begin{array}{r}
 (1) \\
 \begin{array}{r}
 \text{d. bush.} \\
 64 \left\{ \begin{array}{l} 72 \\ 48 \end{array} \right\} 16 \text{ wheat} \} \text{ Ans.} \\
 \hline
 \end{array}
 \end{array}$$

$72 \times 16 = 1152$
 $84 \times 8 = 384$
 \hline
 $24) \quad 1536(64 \text{ proof}^*$
 $\quad \quad \quad 144$
 \hline
 $\quad \quad .. 96$
 $\quad \quad 96$
 \hline

* These examples are proved by Alligation Medium; but may be proved as above. See first example.

ALLIGATION ALTERNATE.

$$(2) \quad \begin{array}{c} \text{lb.} \\ \left\{ \begin{array}{l} 2 = 2 \text{ at } 4 \\ 2 = 2 \text{ at } 5 \\ 1+2=3 \text{ at } 8 \end{array} \right\} \end{array} \text{ per lb.}$$

$$(3) \quad \begin{array}{c} \text{gal.} \\ \left\{ \begin{array}{l} 30+6=36 \text{ at } 6 \ 6 \\ 12 \text{ at } 5 \ 0 \\ 12 \text{ at } 3 \ 0 \end{array} \right\} \end{array} \text{ per gallon.}$$

$$(4) \quad \begin{array}{c} \text{car.} \\ \left\{ \begin{array}{l} 3 \text{ at } 18 \\ 1 \text{ at } 20 \\ 1 \text{ at } 22 \\ 3 \text{ at } 24 \end{array} \right\} \end{array} \text{ caracts fine.}$$

$$(5) \quad \begin{array}{c} \text{bu.} \\ \left\{ \begin{array}{l} 12 \text{ at } 6 \ 0 \\ 6 \text{ at } 5 \ 0 \\ 6 \text{ at } 4 \ 6 \\ 24 \text{ at } 3 \ 0 \end{array} \right\} \end{array} \text{ per b.}$$

$$(6) \quad \begin{array}{c} \text{gal.} \\ \left\{ \begin{array}{l} 4 \text{ at } 16 \\ 4 \text{ at } 12 \\ 3 \text{ at } 9 \\ 1 \text{ at } 5 \\ 4+8=12 \text{ at } 4 \end{array} \right\} \end{array} \text{ per gallon.}$$

Questions of this sort admit of a great variety of answers, for as many different ways as you can link a greater quantity than the mean to a less, so many different answers will be obtained by the rule, and numbers in the same proportion to the differences, will likewise answer the question ad infinitum; for which reason they are called

ALLIGATION PARTIAL.

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by algebraists indeterminate, or unlimited, problems ; and by an analytical process, theorems may be raised that will give all the possible answers to these questions.

ALLIGATION PARTIAL.

$$\text{mean } 64 \left\{ \begin{matrix} d. \\ 72 \\ 48 \end{matrix} \right\} \left\{ \begin{matrix} d. \\ b.w. \\ 16 \end{matrix} \right. \left. \begin{matrix} (1) \\ \text{wheat} \end{matrix} \right\} \text{Answer.}^*$$

$$\text{mean } 6 \left\{ \begin{matrix} 8 \\ 5 \\ 4 \end{matrix} \right\} \left\{ \begin{matrix} \text{diff.} \\ 2+1=3 \text{ at } 8 \\ 2 \text{ at } 5 \\ 2 \text{ at } 4 \end{matrix} \right\} \text{1st Ans.}$$

Then as $\frac{3}{2} : \frac{6}{2} :: \frac{2}{2}$

3)12

Answer 4 lb. of each of the other sorts.

$$\text{d. } \left\{ \begin{matrix} 78 \\ 60 \\ 36 \end{matrix} \right\} \left\{ \begin{matrix} \text{diff.} \\ 30+6=36 \\ 12 \\ 12 \end{matrix} \right\} \text{As } 36 : 18 :: 12$$

$$36 \left\{ \begin{matrix} 6 \\ 216 \\ \hline 6 \\ 36 \end{matrix} \right\}$$

6 gal. of the other
two sorts.

* When two kinds of things only are given to be mixed, the rule of Alligation will give but one answer. If three kinds of things are given to be mixed, it will give but one answer ; but all numbers in the same proportion between themselves and the numbers which compose that answer, will also satisfy the question ; therefore all the examples in this rule are proved by Alligation Medial, they being in the same proportion with those numbers.

$$21 \left\{ \begin{matrix} 18 \\ 20 \\ 22 \\ 24 \end{matrix} \right\} \overline{3} \quad \text{As } 3 : 6 :: 1 \quad 3 : 6 :: 3$$

$$\begin{array}{r} 1 \\ 1 \\ \hline 3) 6 \\ \hline 2 \end{array} \quad \begin{array}{r} 1 \\ 3 \\ \hline 3) 18 \\ \hline 6 \end{array}$$

2 lb. of 20 and 22, and 6 lb. of 24 carats fine.

$$48 \left\{ \begin{array}{l} 72 \\ 60 \\ 54 \\ 42 \\ 36 \end{array} \right\} \left(5 \right) \quad : \quad \begin{array}{r} 12 \\ 6 \\ 6 \\ 6 \\ 24 \end{array}$$

$6 + 12 = 18$

$$b. \quad b. \quad s. \quad d.$$

$$6 : 12 : : \left\{ \begin{array}{l} 6 : 12 \text{ at } 5 \ 0 \\ 6 : 12 \text{ at } 4 \ 6 \\ 18 : 36 \text{ at } 3 \ 6 \\ 24 : 48 \text{ at } 3 \ 0 \end{array} \right\} \text{per bushel.}$$

$$8 \left\{ \begin{array}{l} 16 \\ 12 \\ 9 \\ 5 \\ 4 \end{array} \right\} \left\{ \begin{array}{l} 6 \\ 4 \\ 4 \\ 3 \\ 1 \end{array} \right\} 4 + 8 = 12$$

$$g. \quad g. \quad d.$$

$$\frac{4}{4} : 8 \text{ at } 12$$

$$3 : 6 \text{ at } 9$$

$$1 : 2 \text{ at } 5$$

$$12 : 24 \text{ at } 4$$

per gallon.

ALLIGATION TOTAL.

$$(1)$$

$$3 \left\{ \begin{matrix} 4 \\ 0 \end{matrix} \right\} 3 \quad \frac{g}{4} : \frac{g}{16} :: \left\{ \begin{matrix} g \\ 3 \\ 1 \end{matrix} \right\} : \frac{g}{12 \text{ wine}} \\ \underline{\text{sum } 4} \qquad \qquad \qquad * \text{proof } \underline{16} \text{ gal.}$$

Or, as $16 : 48 :: 1 : 3$ mean price, given proof.

$$(2)$$

$$d \left\{ \begin{matrix} 3 \\ 4 \\ 6 \\ 10 \end{matrix} \right\} \quad \text{diff} \\ \underline{6} \quad \underline{\underline{0+2+3=5}} \quad \underline{\underline{4}} \\ \underline{\text{sum } 17}$$

$$\text{sum } b. \quad \left\{ \begin{matrix} 4 : 26 \frac{4}{5} \text{ at } 3 \\ 4 : 26 \frac{4}{5} \text{ at } 4 \\ 4 : 26 \frac{4}{5} \text{ at } 6 \\ 5 : 92 \frac{4}{5} \text{ at } 10 \end{matrix} \right\} \text{per lb.} \\ \underline{\underline{17 : 112}} \quad \underline{\underline{112 \text{ lb. proof.}}}$$

* The proof is had by finding the value of the whole mixture at the mean rate; which must be equal to the total value of the several simples, or if the sum of the several particulars agree with the given sum, the work is right.

Several authors have given demonstrations of this rule, but those published by Dr. Hatton, in his arithmetic, are the most intelligible of any I have yet seen.

$$\text{mean } 19 \left\{ \begin{array}{c} 22 \\ 20 \\ 18 \\ 17 \\ 14 \end{array} \right\}^{(3)} \left\{ \right\} 2+1=3 \quad \begin{array}{r} 1 \\ 1 \\ 3 \end{array}$$

sum 13

$$\text{sum oz.} \quad \text{13 : 200 :: } \left\{ \begin{array}{l} \text{diff. oz.} \\ 5 : 76\frac{1}{3} \text{ of 22} \\ 3 : 46\frac{2}{3} \text{ of 20} \\ 1 : 15\frac{1}{3} \text{ of 18} \\ 1 : 15\frac{1}{3} \text{ of 17} \\ 3 : 46\frac{2}{3} \text{ of 14} \end{array} \right\} \text{ car. fine.}$$

proof 200 oz. of 19 car. fine

$$56 \left\{ \begin{array}{l} 96 \\ 72 \\ 48 \\ 24 \end{array} \right\} \overline{\overline{32}} \quad \text{sum bush.} \quad 96 : 240 :: \left\{ \begin{array}{l} 32 : 80 \text{ wheat} \\ 8 : 20 \text{ rye} \\ 16 : 40 \text{ barley} \\ 40 : 100 \text{ oats} \end{array} \right\} \text{bush.}$$

sum 96

bush 240 proof.

$$\begin{array}{r}
 (5) \\
 \left\{ \begin{array}{r} 24 \\ 21 \\ 19 \\ 0 \end{array} \right\} \\
 16 \quad 16 \quad 16 \quad 16 \\
 \hline
 3 + 5 + 8 = 16 \\
 \hline
 64 \quad \left\{ \begin{array}{r} 8 \\ 8 \end{array} \right\} \\
 \hline
 64 \quad \left\{ \begin{array}{r} 8 \\ 8 \end{array} \right\} \\
 \hline
 \overline{47\frac{1}{2}} \text{ oz. of each sort} \\
 \overline{4} \\
 \hline
 \overline{190 \text{ oz. proof.}}
 \end{array}$$

EXCHANGE.

ENGLAND WITH FRANCE.

Example (1) is worked.

- (2) $30d. :: 1 \text{ cr.} :: 125l. :: 1900 \text{ cr.}$
- (3) $1 \text{ cr.} :: 30d. :: 280 \text{ liv. } 13 \text{ sol. } 4 \text{ den.} :: 12l.$
 $1s. 8\frac{2}{3}d.$
- (4) $31d. :: 1 \text{ cr.} :: 12l. 1s. 8\frac{2}{3}d. :: 280 \text{ liv. } 13 \text{ sol.}$
 4 den.
- (5) $1 \text{ cr.} :: 4s. 2d. :: 2148 \text{ cr. } 2 \text{ liv. } 4 \text{ sol. } 6 \text{ den.}$
 $:: 447l. 13s. 1\frac{1}{2}d.$
- (6) $2148 \text{ cr. } 2 \text{ liv. } 4 \text{ sol. } 6 \text{ den.} :: 447l. 13s. 1\frac{1}{2}d.$
 $:: 1 \text{ cr.} :: 4s. 2d.$

SPAIN.

Example (1) is worked.

- (2) $6912 \text{ at } 50d. = 1440l.$
- (3) $1 \text{ pia.} :: 48d. :: 2600 \text{ pia. } 6 \text{ ria. } 20 \text{ mar.} ::$
 $520l. 3s. 3\frac{3}{8}d.$
- (4) $48d. :: 1 \text{ pia.} :: 520l. 3s. 3\frac{3}{8}d. :: 2600 \text{ pia.}$
 $6 \text{ ria. } 20 \text{ mar.}$
- (5) $2600 \text{ pia. } 6 \text{ ria. } 20 \text{ mar.} :: 520l. 3s. 3\frac{3}{8}d. ::$
 $1 \text{ pia.} :: 48d.$

PORTUGAL.

Example (1) is worked.

- (2) $14624 \text{ mil. at } 5s. = 3656l.$
- (3) $64d. :: 1 \text{ mil.} :: 360l. 4s. 8d. :: 1350 \text{ mil.}$
 875 rees.
- (4) $1 \text{ mil.} :: 64d. :: 1350 \text{ mil. } 875 \text{ rees.} :: 360l.$
 $4s. 8d.$

EXCHANGE.

HOLLAND, FLANDERS, AND GERMANY.

Example (1) is worked.

- (2) 104 guil. : 100 guil. :: 110 guil. 12 stiv. :
106 guil. 6 stiv. 1 gr. $6\frac{1}{3}$ pen.
- (3) 100 guil. : 105 guil. :: 2840 guil. : 2982 guil.
- (4) 100 guil. : 104 guil. :: 106 guil. 6 stiv. 1 gr.
 $6\frac{1}{3}$ pen. : 110 guil. 12 stiv.
- (5) $640 \times 240 \div 40 = 3840$ guil.
- (6) $3840 \times 40 \div 240 = 640l.$
 $846l. 12s. 207504d.$
- (7) $\frac{40}{40} = \frac{5187}{40}$ guil. 12 stiv.
- (8) 5187 guil. 12 stiv. $\times 40 \div 240 = 864l. 12s.$
- (9) $350l.$ at $34s. = 595l.$
- (10) $1l. : 33s. 6d. :: 842l. 5s. : 1410l. 15s. 4\frac{1}{2}d.$
- (11) $34s. : 1l. :: 595l. : 350l.$
- (12) $33s. 6d. : 1l. :: 1410l. 15s. 4\frac{1}{2}d. : 842l. 5s.$
- (13) $34s. : 1l. :: 5187$ flo. 12 stiv. : $508l. 11s. 9\frac{3}{7}d.$
- (14) $508l. 11s. 9\frac{3}{7}d. : 5187$ flo. 12 stiv. :: $1l. : 34s.$

HAMBRO'.

Example (1) is worked.

- (2) $1l. : 32$ sols gros :: $52l. : 1664$ sols gros;
then, $1664 \times 6 \div 16 = 624$ marks.
- (3) 36 sols gros 1 den. : $1l. :: 1724$ mks. 5 sols
lub. : $127l. 8s. 7\frac{1}{2}\frac{2}{3}\frac{5}{7}d.$
- (4) $1l. : 36$ sols 1 den. :: $127l. 8s. 7\frac{1}{2}\frac{2}{3}\frac{5}{7}d. : 1724$ mks. 5 sols lub.

VENICE.

Example (1) is worked.

- (2) 2208 pia. at $50d. = 460l.$
- (3) 1 pia. : $48d. :: 2918$ pia. 10 sol. : $583l. 14s.$

- (4) 48d. : 1 pia. :: 589l. 14s. : 2918 pia. 10 sol.
 (5) 1 duc. : 53d. :: 4780 duc. 12 sol. 6 den. :
 1055l. 14s. 5½d.
 (6) 53d. : 1 pia. :: 1055l. 14s. 5½d. : 4780 pia.
 12 sol. 6 den.

RUSSIA.

Example (1) is worked.

- (2) 2950 rub. at 4s. 2d.=614l. 11s. 8d.
 (3) 4s. 6d. : 1 rub. :: 940l. 12s. 6d. : 4180 rub.
 55½ cop.
 (4) 1 rub. : 4s. 6d. :: 4180 rub. 55½ cop. :
 940l. 12s. 6d.

POLAND AND PRUSSIA.

Example (1) is worked.

- (2) First, 270 gros. : 1l. F. :: 11700 flor. :
 1300l. Flem.; then, 33s. 4d. : 1l. :: 1300l.
 F. : 780l.
 (3) First, 1l. : 34s. 4d. :: 875l. 12s. 6d. : 1503l.
 3s. 1½d. Flem.; then, 1l. : 290 gros :: 1503l.
 3s. 1½d. : 4843 rix-dol. 45 gros 5½ pen.
 (4) First, 290 gros : 1l. :: 4843 rix-dol. 45 gros
 5½ pen. : 1503l. 3s. 1½d. Flem.; then, 34s. 4d.
 : 1l. :: 1503l. 3s. 1½d. : 875l. 12s. 6d.

SWEDEN.

Example (1) is worked.

- (2) 46 cop. dol. : 1l. :: 11316 cop. dol. : 246l.
 (3) 1l. : 48 cop. dol. :: 293l. 15s. : 14100 cop. dol.
 (4) 48 cop. dol. : 1l. :: 14100 cop. dol. : 293l.
 15s.
 (5) 49 cop. dol. : 1l. :: 5838 sil. dol. 9 run. :
 357l. 8s. 8½d.
 (6) 1l. : 49 cop. dol. :: 357l. 8s. 8½d. : 5838
 sil. dol. 9 run.

REDUCTION OF

IRELAND, AMERICA, AND THE WEST INDIES.

Example (1) is worked.

$$(2) \quad 106l. : 100l. :: 795l. : 750l.$$

$$(3) \quad 100l. : 110l. :: 751l. 10s. : 826l. 13s.$$

$$(4) \quad 110l. : 100l. :: 826l. 13s. : 751l. 10s.$$

$$(5) \quad \begin{array}{r|rr} l & l \\ 50 = \frac{1}{2} & | & 726 \text{ at } 100 \text{ per cent.} \\ & & 363 \text{ at } 50 \text{ per cent.} \end{array}$$

~~£~~ 1089

$$(6) \quad 150l. : 100l. :: 1089l. : 726l.$$

$$(7) \quad 160l. : 100l. :: 1089l. 10s. : 680l. 18s. 9d.$$

$$(8) \quad \begin{array}{r|rrr} l & l & s & d \\ 50 = \frac{1}{2} & | & 680 & 18 \\ 10 = \frac{1}{3} & | & 340 & 9 \frac{1}{3} \\ & & 68 & 1 \ 10 \frac{1}{2} \end{array} \begin{array}{l} \text{at } 100 \text{ per cent.} \\ \text{at } 50 \text{ per cent.} \\ \text{at } 10 \text{ per cent.} \end{array}$$

~~£~~ 1089 10 0

ARBITRATION OF EXCHANGES.

Example (1) is worked.

$$(2) \quad 33s. 4d. : 1l. :: 55d. : 33d. per crown.$$

$$(3) \quad 100l. : 103l. :: 33s. 4d. : 1l. 14s. 4d.$$

$$(4) \quad 103l. : 100l. :: 1l. 14s. 4d. : 1l. 13s. 4d.$$

Flem. per ~~£~~ ster.

VULGAR FRACTIONS.

REDUCTION OF VULGAR FRACTIONS.

Example (1) is worked.

$$(2) \quad 5\frac{1}{2}\frac{1}{8}\frac{1}{4}(\frac{1}{2} \text{ ana.}) \quad (3) \quad \frac{5}{8} \times 3 = \frac{15}{8} \quad (4) \quad 5\frac{1}{2}\frac{1}{8}\frac{1}{4} = \frac{15}{8}$$

CASE II.

(5) $4 = \frac{4}{1}$

(6) $6 = \frac{6}{1}$

(7) $8 = \frac{8}{1}$

(8) $12 = \frac{12}{1}$

CASE III.

- (9) $8 \times 4 = 32$; hence $\frac{32}{1}$ is the fraction required.
 (10) $6 \times 5 = 30$; hence $\frac{30}{1}$ is the fraction required.
 (11) $9 \times 6 = 54$; hence $\frac{54}{6}$, the answer.
 (12) $12 \times 10 = 120$; hence $\frac{120}{10}$, the answer.

CASE IV.

- (13) $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4} = \frac{6}{48}$, the single fraction.
 (14) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{24}{60}$
 (15) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{60}{120}$
 (16) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{48}{120}$

CASE V.

- (17) $5\frac{1}{2} = \frac{5 \times 2 + 1}{2} = \frac{11}{2}$
 (18) $6\frac{2}{3} = \frac{6 \times 3 + 2}{3} = \frac{20}{3}$
 (19) $12\frac{4}{5} = \frac{12 \times 5 + 4}{5} = \frac{64}{5}$
 (20) $25\frac{3}{8} = \frac{25 \times 8 + 3}{8} = \frac{203}{8}$

CASE VI.

- (21) $11\frac{2}{3} = 11 + 2 = 5\frac{1}{3}$
 (22) $6\frac{4}{5} = 6 + 4 = 10\frac{4}{5}$
 (23) $12\frac{1}{2} = 12\frac{1}{2}$ or $12\frac{2}{4}$
 (24) $25\frac{3}{4} = 25\frac{3}{4}$

CASE VII.

- (25) $\frac{7}{12} \frac{2}{9}$ has 24 for its common measure.
 (26) $\frac{1}{2} \frac{6}{7} \frac{9}{14}$ has 14 for its common measure.
 (27) $\frac{2}{3} \frac{1}{4} \frac{4}{5} \frac{1}{2}$ has 2 for its common measure.
 (28) $\frac{3}{4} \frac{6}{5} \frac{9}{7} \frac{1}{6}$ has 1 for its common measure

CASE VIII.

- (29) $\frac{1873}{1871} = \frac{1873}{1871}$, having 1 for the common measure;
hence these numbers are prime to one another

(30) $\frac{1416}{1414} = \frac{1416}{1414}$ (31) $\frac{1648}{1646} = \frac{1648}{1646}$
(32) $\frac{2146}{2136} = \frac{2146}{2136}$ (33) $\frac{816}{446} = \frac{816}{446}$
(34) $\frac{2688}{2672} = \frac{2688}{2672}$

CASE IX.

$$(35) \quad \left. \begin{array}{l} \frac{2}{3} \times 4 = \frac{8}{3} \\ \frac{3}{4} \times 3 = \frac{9}{4} \end{array} \right\} \text{the fractions required.}$$

$$\begin{aligned}(36) \quad & \frac{3}{4} \times 5 \times 6 = \frac{90}{120} \\ & \frac{4}{5} \times 4 \times 6 = \frac{96}{120} \\ & \frac{5}{6} \times 5 \times 4 = \frac{100}{120}\end{aligned}$$

$$\begin{aligned} \frac{1}{2} \times 3 \times 4 \times 7 &= \frac{84}{168} \\ \frac{2}{3} \times 2 \times 4 \times 7 &= \frac{168}{168} \\ \frac{3}{4} \times 7 \times 3 \times 2 &= \frac{168}{168} \\ \frac{4}{5} \times 4 \times 3 \times 2 &= \frac{168}{168} \end{aligned}$$

$$\begin{aligned} (98) \quad & \frac{1}{3} \times 4 \times 5 \times 6 = \frac{120}{360} \\ & \frac{1}{4} \times 2 \times 5 \times 6 = \frac{90}{360} \\ & \frac{1}{2} \times 2 \times 4 \times 6 = \frac{120}{360} \\ & \frac{1}{6} \times 5 \times 4 \times 2 = \frac{60}{360} \end{aligned}$$

$$\begin{aligned} \frac{5}{8} \times 9 \times 10 \times 12 &= \frac{5400}{8} \\ \frac{3}{4} \times 8 \times 10 \times 12 &= \frac{3360}{8} \\ \frac{3}{10} \times 12 \times 9 \times 8 &= \frac{3360}{10} \\ \frac{6}{13} \times 10 \times 9 \times 8 &= \frac{3360}{13} \end{aligned} \quad (39)$$

$$\begin{aligned}
 & \frac{1}{2} \times 4 \times 5 \times 6 \times 7 = \frac{840}{35520} \\
 & \frac{1}{4} \times 3 \times 5 \times 6 \times 7 = \frac{630}{35520} \\
 & \frac{1}{2} \times 3 \times 4 \times 6 \times 7 = \frac{504}{35520} \\
 & \frac{1}{6} \times 3 \times 4 \times 5 \times 7 = \frac{420}{35520} \\
 & \frac{1}{4} \times 3 \times 4 \times 5 \times 6 = \frac{360}{35520}
 \end{aligned}$$

VULGAR FRACTIONS.

111

CASE X.

- (41) First, 3s. 6d. = 42 pence, and 1l. = 240 pence; hence $\frac{42}{240}$, the fraction required.
- (42) $6\frac{1}{2} = 13$ halfpence, and 1s. = 24 halfpence; hence $\frac{13}{24}$, the fraction required.
- (43) 3 ro. 12 po. = 432 poles, and 1 acre = 160 poles; hence $\frac{432}{160}$, the fraction required.
- (44) $\frac{2 \text{ qrs. } 12 \text{ lb.}}{112} = \frac{68}{112}$
- (45) $\frac{8\frac{1}{2} \text{ in.}}{12} = \frac{17}{12}$
- (46) $\frac{12\frac{1}{2} \text{ cwt.}}{20} = \frac{25}{40}$ or $\frac{5}{8}$
- (47) 6 oz. 12 dwts. 16 grs. = 3184 grs., and 1 lb. = 5760 grs.; hence $\frac{3184}{5760}$, the fraction required.
- (48) $\frac{3 \text{ qr. } 2 \text{ lb. } 2 \text{ oz. } 6 \text{ drs.}}{1 \text{ cwt.}} = \frac{220\frac{1}{2}}{1440} \text{ drams.}$
-

CASE XI.

- (49) $\frac{4}{5} \text{ of } \frac{1}{2} \text{ of } \frac{1}{2} = \frac{4}{5} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{5}$ or $\frac{1}{20}$
- (50) $\frac{7}{8} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{7}{16}$ or $\frac{7}{4}$
- (51) $\frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$ or $\frac{1}{4}$
- (52) $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$
- (53) $\frac{3}{5} \times \frac{1}{2} \times \frac{1}{2} = \frac{3}{20}$ or $\frac{1}{7}\frac{1}{2}$
- (54) $\frac{7}{8} \cdot \frac{1}{2} = \frac{7}{16}$ or $\frac{7}{8}$
- (55) $\frac{3}{5} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{3}{40}$
- (56) $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{16}$
- (57) $\frac{4}{5} \times \frac{1}{2} = \frac{2}{5}$ or $\frac{1}{10}$
- (58) $\frac{4}{5} \times \frac{1}{2} = \frac{2}{5}$ or $\frac{1}{10}$
- (59) $\frac{3}{5} \times \frac{1}{2} \times \frac{1}{2} = \frac{3}{20}$ or $\frac{1}{7}\frac{1}{2}$
- (60) $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

ADDITION OF

CASE XII.

- (61) $\frac{1}{2}\frac{1}{4}l.=6s. 8\frac{1}{2}d.$
 (62) $\frac{1}{2}\frac{1}{4}l.=3s. 6d.$
 (63) $\frac{1}{2}\frac{1}{4}s.=6\frac{1}{2}d.$
 (64) $\frac{1}{8}\frac{1}{8}$ acre = 3 ro. 12 p
 (65) $\frac{1}{1}\frac{1}{2}$ cwt. = 2 qr. 12 lb.
 (66) $\frac{1}{2}\frac{1}{4}$ foot = 8 $\frac{1}{2}$ inches.
 (67) $\frac{1}{2}\frac{1}{8}$ ton = 12 $\frac{1}{2}$ cwt.
 (68) $\frac{1}{2}\frac{1}{8}\frac{1}{8}\frac{1}{8}$ lb. = 6 oz. 12 dwt. 16 grs.
 (69) $\frac{1}{2}\frac{1}{8}\frac{1}{8}\frac{1}{8}\frac{1}{2}$ cwt. = 3 qrs. 2 lb. 2 oz. 6 grs.
 (70) $\frac{1}{2}\frac{1}{8}\frac{1}{8}\frac{1}{4}$ moi. = 9s. 4 $\frac{1}{4}$ $\frac{1}{2}\frac{1}{8}\frac{1}{4}$ d.

ADDITION OF VULGAR FRACTIONS.

- (1) $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ answer.
 (2) $\frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1$
 (3) $\frac{1}{3} + \frac{1}{3} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3} = 1\frac{1}{3}$ or $1\frac{1}{3}$
 (4) $\frac{1}{5} + \frac{1}{5} = \frac{1}{5} + \frac{1}{5} = \frac{2}{5}$
 (5) $\frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{1}{10} + \frac{1}{12} + \frac{1}{15} = \frac{7}{60}$
 (6) $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{1}{6} + \frac{1}{6} + \frac{1}{5} + \frac{1}{5} = \frac{19}{30} = 2s. 2d.$
- (7)
- | | | | |
|---------------------------------|------------------|--------------------------------|----------------|
| $\frac{1}{2}$ of $\frac{1}{2}$ | $= \frac{1}{4}$ | $s.$ | $d.$ |
| $\frac{1}{10}$ of $\frac{1}{2}$ | $= \frac{1}{20}$ | 0 | 6 |
| $\frac{1}{8}$ of $\frac{1}{2}$ | $= \frac{1}{16}$ | 0 | $0\frac{1}{4}$ |
| | | <hr/> | |
| | | s. 12 | $6\frac{1}{4}$ |
| | | $\frac{1}{2}$ or $\frac{1}{2}$ | |

- (8) First, $\frac{1}{4}$ of a shill. = $\frac{1}{80}$ of a £; then, $\frac{1}{80} + \frac{1}{80} = \frac{2}{80}$
 $+ \frac{2}{80} = \frac{4}{80} = \frac{1}{20}$ of a £ = 8s. $11\frac{1}{4}$ $\frac{1}{2}$ d.
 (9) $6\frac{1}{2} + 7\frac{1}{4} + 8\frac{1}{2} = 6\frac{1}{4} + 7\frac{1}{4} + 8\frac{1}{4} = 22\frac{1}{4}$
 (10) $\frac{1}{4}$ of a week = $\frac{8}{30}$ of an hour; then, $\frac{8}{30} + \frac{1}{4} = \frac{3}{30}$
 $+ \frac{1}{30} = \frac{3}{30} = 94\frac{1}{2}$ hours.

SUBTRACTION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} - \frac{1}{3} = \frac{1}{3}$ or $\frac{1}{3}$ (2) $\frac{5}{6} - \frac{2}{6} = \frac{3}{6}$
 (3) $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ (4) $\frac{1}{8} - \frac{1}{16} = \frac{1}{16}$
 (5) $12\frac{1}{2} - \frac{2}{3} = 6\frac{1}{2} = 6\frac{1}{2}$ (6) $14\frac{1}{4} - 8\frac{1}{8} = 6\frac{1}{8} = 6\frac{1}{8}$
 (7) $862\frac{1}{2} - 224\frac{1}{4} = 637\frac{1}{4}$ (8) $961\frac{1}{2} - 460\frac{1}{2} = 500\frac{1}{2}$
 (9) $\frac{2}{3} - \frac{1}{6} = \frac{4}{6} - \frac{1}{6} = \frac{1}{2}$
 (10) First, $\frac{2}{3}$ of $\frac{1}{2} = \frac{1}{3}$; then $\frac{1}{4} - \frac{1}{12} = \frac{3}{12} - \frac{1}{12} = \frac{2}{12}$
 (11) $1 - \frac{1}{4} = \frac{3}{4} - \frac{1}{4} = \frac{2}{4}$ or $\frac{1}{2}$
 (12) $64 - \frac{1}{4} = 63\frac{3}{4}$ or $63\frac{3}{4}$

Fractions being such, or reduced to such a state, that all the numerators represent things of the same denomination, both absolute and relative, their sum or difference must therefore be a number of such parts as the common denominator expresses; whence the reason of addition and subtraction is manifest.

MULTIPLICATION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ or $\frac{8}{15}$ (2) $\frac{3}{5} \times \frac{6}{10} = \frac{18}{50}$ or $\frac{9}{25}$
 (3) $\frac{4}{5} \times \frac{5}{6} = \frac{20}{30}$ or $\frac{5}{3}$ (4) $\frac{2}{3} \times \frac{3}{5} = \frac{6}{15}$ or $\frac{2}{5}$
 (5) $7\frac{1}{2} \times \frac{1}{2} = \frac{15}{2} \times \frac{1}{2} = \frac{15}{4} = 3\frac{3}{4}$
 (6) $3\frac{1}{4} \times 12 = \frac{13}{4} \times 12 = 39$
 (7) $\frac{2}{3} \times \frac{2}{5} \times \frac{1}{2} = \frac{1}{3}$ or $\frac{1}{3}$
 (8) $\frac{2}{3} \times \frac{2}{5} \times \frac{2}{3} \times \frac{1}{2} = \frac{256}{1350}$ or $\frac{64}{3375}$
 (9) $12l. 6s. 8\frac{1}{2}d. \times 3 = 37l. 0s. 1d.$
 (10) $6l. 12s. 4\frac{1}{2}d. \times 4 = 26l. 9s. 7\frac{1}{2}d.$

DIVISION OF VULGAR FRACTIONS.

- (1) $\frac{8}{5} \times \frac{5}{3} = \frac{40}{15}$ answer. (2) $\frac{4}{5} \times \frac{10}{9} = \frac{40}{45}$ or $1\frac{1}{9}$
 (3) $\frac{1}{15} \times \frac{10}{3} = \frac{10}{45}$ (4) $\frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$
 (5) $7\frac{1}{2} \times \frac{2}{3} = \frac{15}{2} \times \frac{2}{3} = \frac{15}{3}$ (6) $3\frac{1}{4} \times \frac{1}{3} = \frac{13}{4} \times \frac{1}{3} = \frac{13}{12}$
 (7) $\frac{2}{3} \times \frac{2}{5} \times \frac{1}{2} = \frac{1}{3}$ (8) $\frac{2}{3}$ of $\frac{1}{2} \times \frac{2}{5} \times \frac{1}{2} = \frac{2}{15}$
 (9) $37l. 0s. 1d. + 3 = 12l. 6s. 8\frac{1}{2}d.$
 (10) $26l. 9s. 7\frac{1}{2}d. + 4 = 6l. 12s. 4\frac{1}{2}d.$

RULE OF THREE DIRECT IN VULGAR FRACTIONS.

- (1) $\frac{1}{2}$ yd. : $\frac{2}{3}$ l. :: $(2\frac{1}{2} \text{ yds.} =)\frac{5}{2}$: $\frac{10}{3}l. = 4\frac{2}{3}l.$ ans.
- (2) $\frac{1}{4}l.$: $\frac{5}{2}$ yds. :: $\frac{2}{3}l.$: $\frac{10}{3} \text{ yd.} = \frac{1}{2} \text{ yd.}$
- (3) $4\frac{1}{2} \text{ yds.} = \frac{19}{4}$, $4l. 10s. = 4\frac{1}{2} = \frac{9}{2}$, and $11\frac{1}{2} \text{ yds.} = \frac{33}{2}$; then, $\frac{19}{4} \text{ yd.} : \frac{2}{3}l. :: \frac{33}{2} \text{ yd.} : \frac{85}{6}l. = 10\frac{1}{6}l.$
- (4) $1\frac{9}{10}l.$: $4\frac{1}{2}l.$:: $2\frac{1}{4}0l.$: $\frac{2160}{200}l. = 10l. 16s.$
- (5) First, $1l. 15s. = \frac{35}{4}$, and $52l. 10s. = \frac{1050}{20}$; then, $\frac{35}{4}l.$: $\frac{1050}{20} \text{ d.} :: \frac{1050}{200}l. : \frac{21000}{200} \text{ d.} = 300 \text{ days.}$
- (6) $2\frac{9}{10} \text{ d.} : \frac{1050}{20}l. :: 1\frac{9}{10} \text{ d.} : \frac{10500}{200}l. = 1l. 15s.$
- (7) $7\frac{2}{5}l.$: $7\frac{2}{5} \text{ gal.} :: 1\frac{1}{4}l. : \frac{15840}{792} \text{ gal.} = 200 \text{ gall.}$
- (8) $2\frac{9}{10} \text{ gal.} : 1\frac{1}{4}l. :: 7\frac{2}{5} \text{ gal.} : \frac{7920}{792}l. = 39l. 12s.$
- (9) $2\frac{1}{4}9l.$: $\frac{1}{2} \text{ ship.} :: 7\frac{1}{4}l. : \frac{149}{4} \text{ ship.} = \frac{1}{2} \text{ of her.}$
- (10) First, $40\frac{1}{2} = \frac{81}{2}$, $1l. 15s. = 1\frac{1}{4} = \frac{5}{4}$, and $24\frac{1}{2} \times 50 = \frac{245}{2}$; then, $\frac{81}{2} \text{ ft.} : \frac{5}{4}l. :: \frac{245}{2} \text{ ft.} : \frac{3430}{848}l. = 52l. 18s. 7\frac{1}{2}d.$
- (11) $\frac{7}{2} \text{ cwt.} : \frac{21}{4}l. :: 4\frac{5}{4} \text{ cwt.} : \frac{180}{112}l. = 16l. 17s. 6d.$
- (12) First, $16l. 17s. 6d. = \frac{945}{6}l.$, $11\frac{1}{4} = \frac{45}{4}$, and $5 \text{ gui.} = \frac{21}{4}$; then, $\frac{945}{6}l. : \frac{45}{4} \text{ cwt.} :: \frac{21}{4}l. : \frac{52920}{1512} \text{ cwt.} = 3\frac{1}{2} \text{ cwt.}$

RULE OF THREE INVERSE IN VULGAR FRACTIONS.

Example (1) is worked.

- (2) First, $6\frac{2}{3} = \frac{20}{3}$, and $2\frac{1}{2} = \frac{5}{2}$; then, $\frac{20}{3} \text{ yd.} : \frac{5}{2} \text{ yd. w.} = 2 \text{ yards, ans.}$
- (3) First, $40 \times 5\frac{1}{2} = 220 \text{ yds.}$, and $4 \times 5\frac{1}{2} = 22 \text{ yds.}$; then $\frac{22}{2} \text{ yd.} : \frac{22}{1} \text{ yd.} :: \frac{3}{2} \text{ yd.} : \frac{908}{3} = 293\frac{1}{3} \text{ yds. long.}$
- (4) First, $50\frac{2}{3} = 1\frac{52}{3}l.$, $6\frac{1}{4} = \frac{27}{4} \text{ mo.}$, and $21\frac{1}{2} = \frac{43}{2}l.$; then $\frac{152}{3}l. : \frac{27}{4}l. :: \frac{43}{2}l. : \frac{8808}{516} \text{ mo.} = 15 \text{ mo. } 3 \text{ wks. } 4\frac{1}{3} \text{ days.}$

RULE OF FIVE IN VULGAR FRACTIONS.

Example (1) is worked.

$$\begin{aligned}
 (2) \quad & \text{First, } 26l. 5s. = 26\frac{1}{4} = 105 \\
 & \text{then, } *7\frac{0}{1}l. : 1\frac{0}{4}l. :: 1\frac{0}{1}l. \\
 & * \frac{7}{1}l. : \frac{12}{4}l. :: - \\
 \therefore \quad & \frac{105 \times 100 \times 12}{700 \times 12} = \frac{126000}{25200} = 5l. \text{ ans.}
 \end{aligned}$$

$$(3) \quad \text{First, } 25\frac{1}{2} = \frac{51}{2} \\ \text{then, } * \frac{13}{1} : \frac{51}{2} :: \frac{28}{4} \\ * \frac{4}{4} : \frac{51}{2} :: \frac{10}{4} \\ \frac{28}{4} \times \frac{39}{4} \times \frac{51}{2} = \frac{31408}{164} \\ \therefore \frac{13}{4} \times \frac{4}{4} = \frac{51}{2} = 51408 = 494\frac{4}{13} \text{ rods.}$$

$$(4) \quad \begin{array}{rccccc} & \text{wks.} & \text{£} & & \text{wks.} \\ *4^2 & : & 2\frac{4}{10} & : & 2^2 \\ *1^2 & : & \underline{\quad} & : & 2^8 \\ 2\frac{4}{10} \times 2^2 \times 2^8 & = & 618240 & & \\ \text{then, } \frac{4^2 \times 1^2}{504} & = & \frac{618240}{504} & = & 1226 \frac{2}{3} l. = 1226l. \end{array}$$

$$(5) \quad \frac{\frac{5}{4}d.}{\frac{5}{4}d.} : \frac{\frac{1}{4}}{\frac{1}{4}} : : \frac{\frac{3}{4}0}{\frac{3}{4}0} \\ \text{then, } \frac{\frac{4}{5}0 \times \frac{1}{4} \times \frac{3}{4}}{\frac{4}{5} \times \frac{4}{5}} = \frac{3780}{108} = 35 \text{ tailors.}$$

$$(6) \quad \text{First, } 6\frac{1}{2} = \frac{13}{2} \\ \text{then, } * \frac{1}{4} \text{ cwt. : } \frac{13}{2} d. : : \frac{4}{1} \text{ cwt.} \\ * \frac{20}{1} \text{ m. } \quad \frac{13}{2} d. \\ \frac{13}{2} \times \frac{4}{1} \times \frac{10}{1} = \frac{650}{2} = 325 \\ \therefore \frac{1}{4} \times \frac{20}{1} = \frac{50}{2} = 25 \text{ d.} = 13s. 6\frac{1}{2} d.$$

[†] For the division of this fraction by $\frac{1}{2}$, and also for the succeeding questions, see Rule, page 128. *Arithmetician's Guide.*

116 MULTIPLICATION OF DECIMALS.

DECIMAL FRACTIONS.

ADDITION OF DECIMALS.

$$\begin{array}{r} (1) \\ 447\cdot93 \\ \hline \end{array}$$

$$\begin{array}{r} (2) \\ 46\cdot737 \\ \hline \end{array}$$

$$\begin{array}{r} (3) \\ 4594\cdot5 \\ \hline \end{array}$$

$$\begin{array}{r} (4) \\ 7\cdot479 \\ \hline \end{array}$$

$$\begin{array}{r} (5) \\ 49\cdot131 \\ \hline \end{array}$$

$$\begin{array}{r} (6) \\ 474\cdot90 \\ \hline \end{array}$$

SUBTRACTION OF DECIMALS.

$$\begin{array}{r} (1) \\ 442\cdot7 \\ \hline \end{array}$$

$$\begin{array}{r} (2) \\ 55\cdot301 \\ \hline \end{array}$$

$$\begin{array}{r} (3) \\ 7\cdot6216 \\ \hline \end{array}$$

$$\begin{array}{r} (4) \\ 7\cdot833 \\ \hline \end{array}$$

$$\begin{array}{r} (5) \\ 65179 \\ \hline \end{array}$$

$$\begin{array}{r} (6) \\ 4485\cdot4 \\ \hline \end{array}$$

MULTIPLICATION OF DECIMALS.

(1) $3046825 \times 234 = 71\cdot295705$ answer.

(2) $3046825 \times 23\cdot4 = 7\cdot1295705$

(3) $431162163 \times 2.48 = 1\cdot06928216424$

(4) $324637254 \times .567 = 184069323018$

(5) $478\cdot216243 \times 12\cdot3456789 = 5903\cdot9041808423727$

(6) $1234\cdot56789 \times 487\cdot216243 = 590390\cdot41808423727$

MULTIPLICATION OF DECIMALS. - 117

CONTRACTIONS.

(1)	(2)
.3046825 multiplicand.	.9046825 multiplicand.
432 multiplier inverted.	4.32 multiplier inverted.

$ \begin{array}{r} 609 \\ 914 \\ 121 \\ \hline 71.28 \text{ product.} \end{array} $	$ \begin{array}{r} 609 \\ 91 \\ 12 \\ \hline 7.12 \text{ product.} \end{array} $
---	--

$ \begin{array}{r} (3) \\ .431162163 \\ 84.2 \\ \hline 86 \\ 17 \\ 3 \\ \hline 1.06 \text{ product.} \end{array} $	$ \begin{array}{r} (4) \\ .324637254 \\ 765.0 \\ \hline 162 \\ 19 \\ 2 \\ \hline .183 \text{ product.} \end{array} $
--	--

$ \begin{array}{r} (5) \\ 478.216243 \\ 9876543.21 \\ \hline 4782162 \\ 956432 \\ 143464 \\ 19128 \\ 2391 \\ 286 \\ 33 \\ 3 \\ \hline 590387. \text{ product.} \end{array} $	$ \begin{array}{r} (6) \\ 1234.56789 \\ 342612.874 \\ \hline 493827 \\ 86419 \\ 9876 \\ 246 \\ 12 \\ 7 \\ \hline 590387. \text{ product.} \end{array} $
---	--

DIVISION OF DECIMALS.

Example (1) is worked.

- (2) $31415926 \div 57926 = 54234.5$ answer.
- (3) $3.1415926 \div 57926 = .0000542$
- (4) $3.1415926 \div 57.926 = .542$
- (5) $31415926 \div 57926 = 54234.585$
- (6) $31.415926 \div 57926 = 5.42345$
- (7) $.31415926 \div 57926 = .00000542$
- (8) $.31415926 \div 5.7926 = .0542$
- (9) $.31415926 \div 57926 = .542$

CONTRACTIONS.

$$(1)$$

$$\begin{array}{r} 412\cdot35678)12884\cdot970983029794(31\cdot24 \\ 12370 \\ \hline \end{array}$$

$$\begin{array}{r} 514 \\ 412 \\ \hline 102 \\ 82 \\ \hline 20 \\ 16 \\ \hline 4 \\ - \end{array}$$

DIVISION OF DECIMALS.

119

$$(2) \\ 232.14678)5445.418058704098(23.45$$

$$\dots \quad \underline{4642}$$

$$\underline{808}$$

$$\underline{696}$$

$$\underline{107}$$

$$\underline{92}$$

$$\underline{15}$$

$$\underline{11}$$

$$\underline{4}$$

$$\underline{-}$$

$$(3)$$

$$12345.6789)5903.9041808423727(47821$$

$$\dots \quad \underline{49382}$$

$$\underline{9657}$$

$$\underline{8641}$$

$$\underline{1016}$$

$$\underline{987}$$

$$\underline{29}$$

$$\underline{24}$$

$$\underline{5}$$

$$\underline{1}$$

$$\underline{4}$$

$$\underline{-}$$

REDUCTION OF DECIMALS

(4)

$$4782162\cdot43)590390418\cdot08423727(123\cdot456789$$

..... 478216243

$$\begin{array}{r} 112174175 \\ - 95643248 \\ \hline \end{array}$$

$$\begin{array}{r} 16530927 \\ - 14346487 \\ \hline \end{array}$$

$$\begin{array}{r} 2184440 \\ - 1912864 \\ \hline \end{array}$$

$$\begin{array}{r} 271576 \\ - 239108 \\ \hline \end{array}$$

$$\begin{array}{r} 32468 \\ - 28692 \\ \hline \end{array}$$

$$\begin{array}{r} 3776 \\ - 3347 \\ \hline \end{array}$$

$$\begin{array}{r} 429 \\ - 382 \\ \hline \end{array}$$

$$\begin{array}{r} 47 \\ - 42 \\ \hline 5 \\ - \end{array}$$

REDUCTION OF DECIMALS.

CASE I.

$$(1) \\ 4)1\cdot00$$

$$\begin{array}{r} \hline \\ \hline \\ \hline \end{array} \\ \cdot25 \text{ ans.}$$

$$(2) \\ 2)1\cdot0$$

$$\begin{array}{r} \hline \\ \hline \\ \hline \end{array} \\ \cdot5$$

REDUCTION OF DECIMALS.

121

(3)

$$4)3\cdot00$$

$$\underline{-}\cdot75$$

(4)

$$3)1\cdot0000$$

$$\underline{\underline{-}}\cdot3333, \text{ &c.}$$

(5)

$$12)7\cdot0000$$

$$\underline{\underline{-}}\cdot5833$$

(6)

$$193)14\cdot0000(\cdot0725$$

(7)

$$\begin{matrix} 6 \\ 4 \\ \hline \end{matrix}$$

$$4)27\cdot00$$

$$\underline{\underline{-}}\cdot675$$

(8)

$$\begin{matrix} 8\frac{4}{12} \\ 12 \\ \hline \end{matrix}$$

$$12)100\cdot000$$

$$\underline{\underline{-}}8\cdot333$$

(9)

$$3842)226\cdot0000(\cdot0588$$

(10)

$$4806)2402\cdot000(\cdot0499$$

To reduce a decimal to a vulgar fraction, is no more than to divide by the greatest common measure; the denominator of the decimal being 10, 100, 1000, &c. as in example (1) $\frac{24}{1000}$ =in its lowest terms, $\frac{6}{25}$, the vulgar fraction given.

CASE II.

(1)

$$12)4\cdot000$$

$$\underline{\underline{-}}\cdot333 \text{ ans.}$$

(2)

$$\begin{matrix} 6 \\ 2 \\ \hline \end{matrix}$$

$$24 \left\{ \begin{array}{l} 4)19\ 00 \\ 6)3\cdot250 \\ \hline \cdot5416 \end{array} \right.$$

a

REDUCTION OF DECIMALS.

$$(3) \quad \begin{array}{r} 10\cdot000 \\ 12) \\ -\underline{833} \\ \hline \end{array}$$

$$(4) \quad \begin{array}{r} 5\frac{1}{2} \\ 2 \\ \hline 24 \left\{ \begin{array}{r} 4) 11\cdot00 \\ -\underline{96} \\ \hline 140 \\ 6) \quad \underline{140} \\ \hline 0 \end{array} \right. \\ \hline 4583 \end{array}$$

$$(5) \quad 36 = \left\{ \begin{array}{r} 6) 6 \\ -\underline{6) 1\cdot000} \\ \hline \cdot166 \end{array} \right.$$

$$(6) \quad \begin{array}{r} 9\frac{1}{2} \\ 2 \\ \hline 72 = \left\{ \begin{array}{r} 6) 19\cdot000 \\ -\underline{12) 3\cdot166} \\ \hline \cdot263 \end{array} \right. \end{array}$$

$$(7) \quad 1760) 220\cdot00(1\cdot125$$

$$(8) \quad 1760) 660\cdot00(3\cdot75$$

$$(9) \quad \begin{array}{r} 20) 18\cdot0 \\ -\underline{16} \\ \hline \cdot9 \end{array}$$

$$(10) \quad \begin{array}{r} s. \quad d. \\ 16 \quad 9 \\ -\underline{12} \\ \hline 240) 201\cdot00(8\cdot83 \end{array}$$

$$(11) \quad \begin{array}{r} 12) 8\cdot000 \\ -\underline{666} \\ \hline \end{array}$$

$$(12) \quad \begin{array}{r} lb. \quad dw. \\ 1 = 240) 6\cdot00(0\cdot025 \end{array}$$

REDUCTION OF DECIMALS.

123

$$(13) \quad \begin{array}{r} 112)14\cdot000(125 \\ -112 \\ \hline 280 \\ -224 \\ \hline 560 \\ -560 \\ \hline 0 \end{array}$$

$$(14) \quad \begin{array}{r} 16 \left\{ \begin{array}{r} 4)6\cdot0 \\ -4 \\ \hline 20 \\ -16 \\ \hline 4 \\ -4 \\ \hline 0 \end{array} \right. \\ 4)1\cdot500 \\ \hline .875 \end{array}$$

$$(15) \quad \begin{array}{r} ton \quad gall. \\ 1=252)70\cdot00(27 \\ -70 \\ \hline 0 \end{array}$$

$$(16) \quad \begin{array}{r} year \quad days \\ 1=365)90\cdot0(2465 \\ -365 \\ \hline 0 \end{array}$$

$$(17) \quad \begin{array}{r} day \quad hours \\ 1=24)9\cdot000(375 \\ -24 \\ \hline 75 \\ -72 \\ \hline 3 \end{array}$$

$$(18) \quad \begin{array}{r} day \quad min. \\ 1=1440)8\cdot000(0055 \\ -8640 \\ \hline 360 \\ -360 \\ \hline 0 \end{array}$$

$$(19) \quad \begin{array}{r} qt. \quad p. \\ 4 \quad 1 \\ \hline 2 \end{array}$$

$$(20) \quad \begin{array}{r} acre \quad poles \\ 1=160)26\cdot00(162 \\ -160 \\ \hline 0 \end{array}$$

$$\begin{array}{r} bar. \quad pts. \\ 1=256)9.000(035 \\ -256 \\ \hline 0 \end{array}$$

Case III.

$$(1) \quad \begin{array}{r} .333 \\ 12 \\ \hline \end{array}$$

$$\text{inches } \underline{\underline{4\cdot000}} \text{ ans.}$$

$$(2) \quad \begin{array}{r} .5416 \\ 12 \\ \hline \end{array}$$

$$\underline{\underline{6\cdot5000}} \quad 4$$

$$\underline{\underline{2\cdot0000}} = 6\frac{1}{2} \text{ in.}$$

$$(3) \quad \begin{array}{r} .833 \\ 12 \\ \hline \end{array}$$

$$\underline{\underline{10\cdot000}} \text{ inches.}$$

REDUCTION OF DECIMALS.

(4)

$$\begin{array}{r} .4583 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 5.5000 \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 2.0000 = 5\frac{1}{2} \text{ inches.} \\ \hline \end{array}$$

(5)

$$\begin{array}{r} .166 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \times 6 = 36 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 1.000 \\ 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 6.000 \text{ inches.} \\ \hline \end{array}$$

(6)

$$\begin{array}{r} .263 \\ \times 6 \\ \hline \end{array}$$

$$6 \times 6 = 36$$

$$\begin{array}{r} \hline 1578 \\ 6 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 9.468 \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 1.872 = 9\frac{1}{2} \text{ inches.} \\ \hline \end{array}$$

(7)

$$\begin{array}{r} .125 \\ \times 6 \\ \hline \end{array}$$

$$1760$$

$$\begin{array}{r} \hline 7500 \\ 875 \\ \hline \end{array}$$

$$\begin{array}{r} 125 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 220.000 \text{ yards.} \\ \hline \end{array}$$

(8)

$$\begin{array}{r} 1760 \\ \times 375 \\ \hline \end{array}$$

$$\begin{array}{r} 375 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 660.000 \text{ yards.} \\ \hline \end{array}$$

(9)

$$\begin{array}{r} .9 \\ \times 20 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 18.0 \text{ shillings.} \\ \hline \end{array}$$

(10)

$$\begin{array}{r} .83 \\ \times 20 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 16.60 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 7.20 = 16s. 7d. \\ \hline \end{array}$$

(11)

$$\begin{array}{r} .666 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 8.000 \text{ oz.} \\ \hline \end{array}$$

REDUCTION OF DECIMALS. 125

$$(12) \quad \begin{array}{r} .025 \\ -12 \\ \hline .300 \\ -20 \\ \hline 6.000 \text{ dwt.} \end{array}$$

$$(13) \quad \begin{array}{r} .125 \\ -112 \\ \hline 14.000 \text{ lb.} \end{array}$$

$$(14) \quad \begin{array}{r} .375 \\ -16 \\ \hline 6.000 \text{ oz.} \end{array}$$

$$(15) \quad \begin{array}{r} 252 \text{ gal.} = 1 \text{ tun.} \\ -27 \\ \hline 68.05 \text{ gals.} \end{array}$$

$$(16) \quad \begin{array}{r} .2465 \\ -365 \\ \hline 89.9725 \text{ days.} \end{array}$$

$$(17) \quad \begin{array}{r} .375 \\ -24 \\ \hline 9.000 \text{ hours.} \end{array}$$

$$(18) \quad \begin{array}{r} .005 \\ -24 \\ \hline 0.120 \\ -60 \\ \hline 7.200 \text{ minutes.} \end{array}$$

$$(19) \quad \begin{array}{r} .035 \\ 256 = \text{pints in 1 bar.} \\ \hline 8.960 \text{ pints.} \end{array}$$

126 SQUARE ROOT OF VULGAR FRACTIONS.

(20)

$$\begin{array}{r} \cdot 162 \\ 160 \\ \hline 25.920 \text{ poles.} \end{array}$$

EXTRACTION OF THE SQUARE ROOT.

Example (1) is worked.

(2) $\sqrt{1728} = 41 + *$ ans.

(3) $\sqrt{3456} = 58 +$

(4) $\sqrt{49864} = 223 +$

(5) $\sqrt{345678} = 587.94$

(6) $\sqrt{4567899} = 2137 +$

(7) $123456789 = 11111 \cdot 11106 +$

(8) $\sqrt{987654 \cdot 321} = 993.807990006 +$

(9) $\sqrt{123456789123456789} = 351365606062199532$
69435 +

SQUARE ROOT OF VULGAR FRACTIONS.

$\sqrt{\frac{9}{16}} = \frac{3}{4}$, the root.

$\sqrt{\frac{16}{25}} = \frac{4}{5}$, the root.

$\sqrt{\frac{3}{16}} = \frac{\sqrt{3}}{4}$, the root.

$\sqrt{\frac{4}{25}} = \frac{2}{5}$, the root.

$\sqrt{\frac{1}{16}} = \frac{1}{4}$, or $\frac{1}{4}$ the root. (5) (6)
 $6\frac{1}{4} = \frac{25}{4}$; then $\sqrt{\frac{25}{4}} = \frac{5}{2} = 2\frac{1}{2}$,
the root.

* When a cross appears after the answer, it signifies a remainder; or that the given number is not a complete power; therefore, the root may be continued to any number of places of decimals.

SURDS.

(1) First, $\frac{96}{120} = \frac{4}{5}$, in its lowest terms; and $\frac{4}{5}$, reduced to a decimal = .8.

$$\begin{array}{r} \cdot\cdot\cdot\cdot \\ \text{First, } \frac{96}{120} = \frac{4}{5}, \text{ in its lowest terms; and } \frac{4}{5}, \text{ reduced to a decimal = .8.} \\ \cdot\cdot\cdot\cdot \\ \begin{array}{r} 800000(894, \text{ ans.} \\ 64 \\ \hline 169) 1600 \\ 1521 \\ \hline 1784) 7900 \\ 7136 \\ \hline 764 \\ \hline \end{array} \end{array}$$

(2) First, $\frac{4}{5}$, reduced to a decimal = .75; then

$$\begin{array}{r} 38\cdot7500(6\cdot22 \\ 36 \\ \hline 122) 275 \\ 244 \\ \hline 1242) 3100 \\ 2484 \\ \hline 616 \\ \hline \end{array}$$

- (3) First, $86\frac{1}{2} = 86.5$; then, $\sqrt{86.5} = 9.3$
 (4) First, $\frac{9}{12} = \frac{3}{4} = .75$; then, $\sqrt{462.75} = 21.51$
 (5) $\sqrt{26} = 5\frac{2}{5}$

USE OF THE SQUARE ROOT.

CASE I.

- (1) $\sqrt{32 \times 18} = \sqrt{256} = 24$, ans.
 (2) $\sqrt{20 \times 12} = \sqrt{240} = 15.49$
 (3) $\sqrt{6 \times 4} = \sqrt{24} = 4.898$
 (4) $\sqrt{18.5 \times 12.5} = \sqrt{231.25} = 15.2$
 (5) $\sqrt{40 \times 30} = \sqrt{1200} = 34.6$

CASE II.

(1) $\sqrt{576} = 24$

(2) $\sqrt{240} = 15.49$

(3) $\sqrt{24} = 4.89$

(4) $\sqrt{231.25} = 15.2$

CASE III.

(1) First, $1 : 1.2732 :: 576 : 733.3632$; then,
 $\sqrt{733.3632} = 27.09$, the diameter.

(2) $355 : 452 :: 7854 : 1 \therefore, \sqrt{1} = 1$, the diameter.

(3) $1 : 1.2732 :: 38.5 : 49.0182$; then,
 $\sqrt{49.0182} = 7$, in the diameter.

(4) $1 : 1.2732 :: 363.05 : 462.23526$; then,
 $\sqrt{462.23526} = 21.499$ inches, diameter.

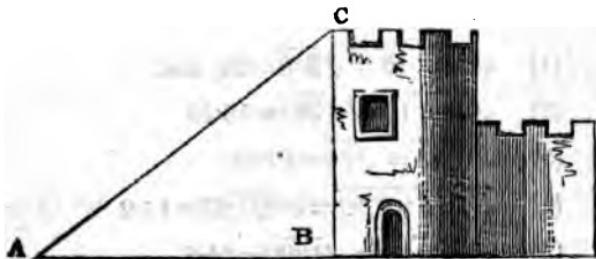
CASE IV.

(1) $\sqrt{48^2 + 20^2} = \sqrt{2704} = 52$ yards.

(2) $\sqrt{52^2 - 48^2} = \sqrt{400} = 20$ yards.

(3) $\sqrt{52^2 - 20^2} = \sqrt{2304} = 48$ yards.

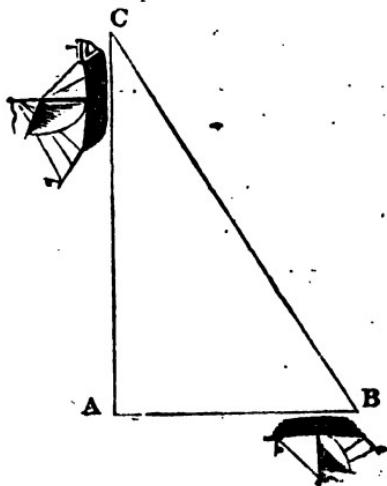
(4) $\sqrt{40^2 + 30^2} = \sqrt{2500} = 50$ yards, A C.



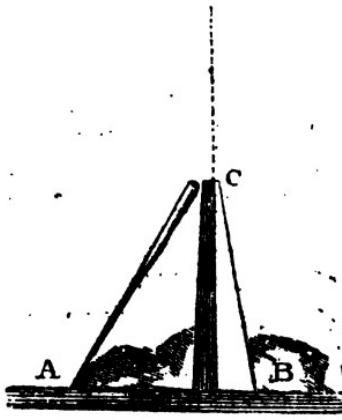
USE OF THE SQUARE ROOT.

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$$(5) \sqrt{60^2 - 40^2} = \sqrt{2000} = 44 \text{ lea.} = BC.$$



$$(6) \sqrt{25^2 - 15^2} = \sqrt{400} = 20 \text{ feet, the length of the piece left standing; hence, } 20 + 25 = 45, \text{ the whole length.}$$



$$(7) \text{ First, } 13s. 0\frac{1}{4}d. = 625 \text{ farthings; then, } \sqrt{625} = 25 \text{ men; hence each man paid } 25 \text{ farthings, or } 6\frac{1}{4}d.$$

190 EXTRACTION OF THE CUBE ROOT.

- (8) First, 11*l.* 5*s.* 4*d.* = 2704 pence; then, $\sqrt[3]{2704} = 15$ men, \therefore each man paid 52*d.*, or 4*s.* 4*d.*
- (9) $\sqrt{321489} = 567$ men.
- (10) $\sqrt[3]{24 \times 16 \times 14} = \sqrt[3]{5376} = 73\cdot 3$ feet, the quantity of light required.

$$\begin{array}{rcl}
 22 & \text{head.} & 2)30 \text{ length.} \\
 26 & \text{bung.} & \overline{-} \quad \text{Then, } 24^2 = 576 \\
 \hline
 2)48 & & \overline{15} \text{ half.} \quad 15^2 = 225 \\
 & & \overline{-} \\
 & 24 \text{ half sum.} & \overline{\sqrt{801}} = 28\cdot 3 \text{ diag.} \\
 \hline
 & & \overline{-} \quad [\text{required.}]
 \end{array} \tag{11}$$

EXTRACTION OF THE CUBE ROOT.

Example (1) is worked.

- (2) $\sqrt[3]{2197} = 13$ ans. (3) $\sqrt[3]{2744} = 14$
 (4) $\sqrt[3]{2985984} = 144$ (5) $\sqrt[3]{75686967} = 423$
 (6) $\sqrt[3]{644972544} = 864$ (7) $\sqrt[3]{50243409} = 369$
 (8) $\sqrt[3]{12862247607} = 2343$
 (9) $\sqrt[3]{163039787847} = 5463$
 (10) $\sqrt[3]{50023150829736} = 36846$
 (11) $\sqrt[3]{94996712418949125} = 456285$
 (12) $\sqrt[3]{94997087172244118016} = 4562856$
 (13) $\sqrt[3]{3\cdot 46} = 1\cdot 51$
 (14) $\sqrt[3]{50375\cdot 533} = 36\cdot 9$
 (15) $\sqrt[3]{163040\cdot 819968} = 54\cdot 63$
 (16) $\sqrt[3]{8151\cdot 613} = 20\cdot 12$
 (17) $\sqrt[3]{01286226891} = 2343$
 (18) $\sqrt[3]{163\cdot 04} = 5\cdot 463$

TO EXTRACT THE CUBE ROOT OF VULGAR FRACTIONS.

(1) $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$, the root. (2) $\sqrt[3]{\frac{27}{64}} = \frac{3}{4}$, the root.

(3) $\sqrt[3]{\frac{512}{125}} = \frac{8}{5}$, the root. (4) $\sqrt[3]{\frac{875}{125}} = \frac{5}{3}$, the root.

(5) First, $\frac{7}{2}^{\frac{2}{3}} = \frac{8}{3}$; then, $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$, the root. (6) First, $\frac{198}{250} = \frac{87}{125}$; then, $\sqrt[3]{\frac{87}{125}} = \frac{3}{5}$, the root.

(7) First, $2\frac{3}{8} = \frac{27}{8}$; then, $\sqrt[3]{\frac{27}{8}} = \frac{3}{2} = 1\frac{1}{2}$, the root. (8) First, $91\frac{1}{8} = \frac{729}{8}$; then, $\sqrt[3]{\frac{729}{8}} = \frac{9}{2} = 4\frac{1}{2}$, the root.

THE USE OF THE CUBE ROOT.

CASE I.

- (1) $\sqrt[3]{2197} = 13$ inches, answer.
 (2) $\sqrt[3]{2744} = 14$ inches.

CASE II.

- (3) $4^3 : 9 :: 7^3 : 48.234$ lb.
 (4) $80^3 : 500 :: 100^3 : 976.56$ tons.
 (5) $89.1 : 40^3 :: 100 : 71829.4$; then, $\sqrt[3]{71829.4} = 41.5$, the diameter required; again, $89.1 : 20^3 :: 100 : 8978.6$; then, $\sqrt[3]{8978.6} = 20.78$, the depth required.

CASE III.

- (6) $\sqrt[3]{5^3 \times 2} = \sqrt[3]{250} = 6.29$, the side required.
 (7) $\sqrt[3]{6.3^3 + 2} = \sqrt[3]{125.023} = 5$ feet.

- (8) First, $\sqrt[3]{250^3 + 2} = \sqrt[3]{7812500} = 198$, keel
 2dly, $\sqrt[3]{50^3 + 2} = \sqrt[3]{62500} = 39$, midship beam
 3dly, $\sqrt[3]{30^3 + 2} = \sqrt[3]{13500} = 23.8$, depth in the hold.
-

CASE IV.

- (9) First, $108 + 4 = 27$, and $\sqrt[3]{27} = 3$; then, $3 \times 4 = 12$, less mean, and $12 \times 3 = 36$, greater mean; for $1 : 12 :: 36 : 108$ proof.
- (10) First, $500 + 4 = 125$, and $\sqrt[3]{125} = 5$; then, $5 \times 4 = 20$, less mean, and $20 \times 5 = 100$, greater mean; for $4 : 20 :: 100 : 500$ proof.

TO EXTRACT THE ROOTS OF POWERS IN GENERAL.

Example (1) is worked.

(2)

$$\begin{array}{r} 32015587041 \text{ (423 root.)} \\ 256 = 4^4 \\ \hline \end{array}$$

$4^3 \times 4 = 256$) 641 dividend.

$$\begin{array}{r} 3111696 = 42^4 \\ \hline \end{array}$$

$42^3 \times 4 = 296352$) 898627 second dividend.

$$\begin{array}{r} 22015587041 \\ \hline \end{array}$$

USE OF THE CUBE ROOT.

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(3)

$$\begin{array}{r} 18542593318343 \\ 1024 = 4^5 \end{array}$$

$$\begin{array}{r} 4^4 \times 5 = 1280) 3302 \text{ dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 180691232 = 42^6 \\ \hline \end{array}$$

$$\begin{array}{r} 42^4 \times 5 = 15558480) 47347011 \text{ second dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 13542593318343 \\ \hline \end{array}$$

(4)

$$\begin{array}{r} 5728516973659089(423 \text{ root.} \\ 4096 = 4^6 \end{array}$$

$$\begin{array}{r} 4^5 \times 6 = 6144) 16325 \text{ dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 5489031744 = 42^6 \\ \hline \end{array}$$

$$\begin{array}{r} 4^6 \times 6 = 784147392) 2394852296 \text{ second dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 5728516973659089 \\ \hline \end{array}$$

(5)

$$\begin{array}{r} 2423162679857794647(423 \text{ root.} \\ 16384 = 4^7 \end{array}$$

$$\begin{array}{r} 4^6 \times 7 = 28672) 78476 \text{ dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 290539333248 = 42^7 \\ \hline \end{array}$$

$$\begin{array}{r} 42^6 \times 7 = 38423222208) 117769347377 \text{ second dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 2423162679857794647 \\ \hline \end{array}$$

194 SINGLE RULE OF THREE IN DECIMALS.

(6)

$$\begin{array}{r} 1024997813579847135681 \\ 65536 = 4^8 \end{array} \quad [root.]$$

$$\begin{array}{r} 4^7 \times 8 = 131072) \ 359637 \text{ dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 9682651996416 = 42^8 \\ \hline \end{array}$$

$$\begin{array}{r} 42^7 \times 8 = 1844314665984) \ 5673161393824 \text{ second divid.} \\ \hline \end{array}$$

$$\begin{array}{r} 1024997813579847135681 \\ \hline \end{array}$$

(7)

$$\begin{array}{r} 433574075144275338393063 \\ 262144 = 4^9 \end{array} \quad [root.]$$

$$\begin{array}{r} 4^8 \times 9 = 589824) \ 1714300 \text{ dividend.} \\ \hline \end{array}$$

$$\begin{array}{r} 406671383849472 = 42^9 \\ \hline \end{array}$$

$$\begin{array}{r} 42^8 \times 9 = 87143867967714) \ 268926912947933 \text{ second div.} \\ \hline \end{array}$$

$$\begin{array}{r} 433574075144275338393063 \\ \hline \end{array}$$

SINGLE RULE OF THREE IN DECIMALS.

Example (1) is worked.

$$(2) \ 4l. : 2.5 \text{ yds.} :: 4l. : .25 \text{ yds.} = \frac{1}{4} \text{ yd. ans.}$$

$$(3) \text{ First, } 4\frac{3}{4} = 4.75, \ 4l. 10s. = 4.5, \text{ and } 11\frac{1}{2} = 11.5; \\ \text{then, } 4.75 \text{ yds.} : 4.5l. :: 11.5 \text{ yds.} : 10.89l.$$

$$(4) \ 100l. : 4.5l. :: 240l. : 10.8l. = 10l. 16s.$$

RULE OF FIVE IN DECIMALS. 135

- (5) First, $1l. 15s.=1.75$, and $52l. 10s.=52.5$; then,
 $1.75l. : 10 \text{ days} :: 52.5l. : 300 \text{ days}$.
- (6) $300 \text{ days} : 52.5l. :: 10 \text{ days} : 1.75l.=1l.$
 $15s.$
- (7) $39.6l. : 72 \text{ galls.} :: 110l. : 200 \text{ galls.}$
- (8) $200 \text{ galls.} : 110l. :: 72 \text{ galls.} : 39.6l.=$
 $39l. 12s.$
- (9) $22 \text{ yds.} : 220 \text{ yds.} :: 16.5 \text{ yds.} : 293.33 \text{ yds.}$
- (10) $\frac{1}{6}=166 \&c.$; then, $249l. : 166 \text{ ship} :: 747l.$
 $: 4998=\frac{1}{6} \text{ of her.}$
- (11) $40.5 \text{ ft.} : 1.75l. :: 24.5 \text{ ft.} : 52.932l.=52l.$
 $18s. 7\frac{1}{2}d.$
- (12) $3.5 \text{ cwt.} : 5.25l. :: 2.25 \text{ cwt.} : 16.875l.=$
 $16l. 17s. 6d.$
- (13) $16.875l. : 11.25 \text{ cwt.} :: 5.25l. : 3.5 \text{ cwt.}=$
 $3\frac{1}{2} \text{ cwt.}$
- (14) $2 \text{ yds.} : 2.5 \text{ yds.} :: 75 \text{ yds.} : 6.66 \text{ yds.}$
- (15) $6.66 \text{ yds.} : 75 \text{ yds.} :: 2.5 \text{ yd.} : 2 \text{ yds.}$
 nearly.
- (16) $(1 \times 14 \times 11 \times 6=)924 : 120 \text{ lb.} :: (50 \times 20 \times$
 $11 \times 5=)55000 : 7142.857 \text{ lb.}$
-

RULE OF FIVE IN DECIMALS.

Example (1) is worked.

$$(2) \quad \begin{array}{r} \mathcal{L} \\ *700 \\ \hline *9 \text{ m.} \end{array} \quad : \quad \begin{array}{r} \mathcal{L} \\ 26.25 \\ \hline \end{array} \quad :: \quad \begin{array}{r} \mathcal{L} \\ 100 \\ \hline 12 \text{ m.} \end{array}$$

then, $100 \times 12 \times 26.25=31500$ dividend,
 and, $700 \times 9=6300$ divisor,
 $\therefore 31500 \div 6300=5l.$ per cent.

SINGLE FELLOWSHIP.

$$(3) \quad \begin{array}{rcl} days & roods & days \\ *13 & : & 25.5 \\ *4 m. & \hline & 36 m. \end{array} :: \begin{array}{rcl} 28 \\ 36 \end{array}$$

$$\text{then, } \frac{25.5 \times 28 \times 36}{42 \times 4} = \frac{25704}{52} = 494.3 \text{ roods.}$$

$$(4) \quad \begin{array}{rcl} wks. & £ & wks. \\ *42 & : & 240 \\ *12 p. & \hline & 28 p. \end{array} :: \begin{array}{rcl} 92 \\ 28 \end{array}$$

$$\text{then, } \frac{240 \times 92 \times 28}{42 \times 12} = \frac{618240}{504} = 1226.666 = 1226l. 13s. 4d.$$

$$(5) \quad \begin{array}{rcl} r. & T. & s. \\ *6 & : & 3 \\ 1.5 d. & - & 9 d.* \end{array} :: \begin{array}{rcl} 420 \\ 9 \end{array}$$

$$\frac{1.5 \times 3 \times 420}{6 \times 9} = \frac{1890}{54} = 35 \text{ tailors.}$$

$$(6) \quad \begin{array}{rcl} cwt. & d. & cwt. \\ *1 & : & 6.5 \\ *20 m. & \hline & 100 m. \end{array} :: \begin{array}{rcl} 5 \\ 100 \end{array}$$

$$\frac{6.5 \times 5 \times 100}{20} = \frac{3250}{20} = 162.5d. = 13s. 6\frac{1}{2}d.$$

SINGLE FELLOWSHIP.

Example (1) is worked.

- (2) First, $1500 + 900 + 600 = 3000$ joint stock;
then, $600 + 3000 = 2$ common multiplier;

hence, $\left\{ \begin{array}{l} 1500 \\ 900 \\ 600 \end{array} \right\} \times 2 = \frac{\text{£}}{\hline} \begin{array}{l} 300 \text{ A's gain.} \\ 180 \text{ B's gain.} \\ 120 \text{ C's gain.} \end{array}$

£ 600 proof.

- (3) First, $2400 + 9600 + 4000 = 16000$ whole stock ;
then, $1600 \div 16000 = .1$ common multiplier ;

$$\text{hence, } \left\{ \begin{array}{l} 2400 \\ 9600 \\ 4000 \end{array} \right\} \times .1 = \left\{ \begin{array}{l} 240 \text{ A's loss.} \\ 960 \text{ B's loss.} \\ 400 \text{ C's loss.} \end{array} \right.$$

\mathcal{L} 1600 proof.

- (4) First, $1 + 2 + 3 = 6^*$ sum of the ratios ;
then, $480 \div 6 = 80$ common multiplier ;

$$\text{and, } \left\{ \begin{array}{l} 1 \\ 2 \\ 3 \end{array} \right\} \times 80 = \left\{ \begin{array}{l} 80 \text{ 1st person's share.} \\ 160 \text{ 2d person's share.} \\ 240 \text{ 3d person's share.} \end{array} \right.$$

\mathcal{L} 480 proof.

- (5) First, $520 + 680 + 800 = 2000$ amount of credit ;
then, $920 \div 2000 = .46$ common multiplier ;

$$\text{hence, } \left\{ \begin{array}{l} 520 \\ 680 \\ 800 \end{array} \right\} \times .46 = \left\{ \begin{array}{rcl} 239.2 & = & 239 & 4 & 0 \text{ A's due.} \\ 312.8 & = & 312 & 16 & 0 \text{ B's due.} \\ 368.0 & = & 368 & 0 & 0 \text{ C's due.} \end{array} \right.$$

\mathcal{L} 920 0 0 proof.

- (6) First, $360 + 480 + 500 + 600 = 1940$ whole adventure ;
then, $970 \div 1840 = .5$ common multiplier ;

$$\text{whence, } \left\{ \begin{array}{l} 360 \\ 480 \\ 500 \\ 600 \end{array} \right\} \times .5 = \left\{ \begin{array}{l} 180 \text{ A's share.} \\ 240 \text{ B's share.} \\ 250 \text{ C's share.} \\ 300 \text{ D's share.} \end{array} \right.$$

\mathcal{L} 970 proof.

* In questions of this sort, any numbers may be taken at pleasure
that have the same proportions as those proposed.

DOUBLE FELLOWSHIP.

- (7) First, $180 + 240 + 250 + 300 = 970$ whole gain;
then, $970 \div 1940 = .5$ common divisor;

when, $\begin{cases} 180 \\ 240 \\ 250 \\ 300 \end{cases} \div .5 = \begin{cases} 360 \\ 480 \\ 500 \\ 600 \end{cases}$

A's stock. B's stock.
C's stock. D's stock.

£ 1940 proof.

- (8) First, $\frac{1}{3} + \frac{1}{5} = \frac{5}{15} + \frac{3}{15} = \frac{8}{15}$ A and B advanced;
then, $\frac{8}{15} - \frac{5}{15} = \frac{3}{15}$ C's part of the ship, worth 120*l.*

Now by neglecting the denominators we have,

$$11l. : 120l. :: \begin{cases} 24 \\ 21 \\ 11 \end{cases} : \begin{cases} 261\cdot5181 = 261 & 16 & 4\frac{1}{4} \\ 229\cdot0909 = 229 & 1 & 9\frac{3}{4} \\ 120\cdot0000 = 120 & 0 & 0 \end{cases}$$

£ 610 18 2 sloop
[cost.]

DOUBLE FELLOWSHIP.

Example (1) is worked.

(2) First, $\begin{array}{r} \cancel{8} \\ + \cancel{4} \\ \hline 2 \end{array}$
 $\begin{array}{r} \cancel{16} \\ + \cancel{6} \\ \hline 266 \end{array}$

then, $4\cdot66 : 224 :: \begin{cases} 2 \\ 266 \end{cases} : \begin{cases} 96 \\ 128 \end{cases}$

A's stock. B's stock.

£ 224 proof.

(3)

$$\text{First, } 240 \times 8 = 1920 \text{ A's stock and time.}$$

$$500 \times 4 = 2000 \text{ B's stock and time.}$$

$$200 \times 5 = 1000 \text{ C's stock and time.}$$

4920)369·000(·075 common multiplier;

$$\text{then, } \left\{ \begin{array}{l} 1920 \\ 2000 \\ 1000 \end{array} \right\} \times 075 = \left\{ \begin{array}{l} 144 \text{ A's share of the gain.} \\ 150 \text{ B's share of the gain.} \\ 75 \text{ C's share of the gain.} \end{array} \right.$$

£ 369 proof.

(4)

$$\frac{\text{mo}}{11} \quad \frac{9}{20} : 1200 :: \left\{ \begin{array}{l} \text{mo.} \\ 11 \\ 9 \end{array} \right\} : \left\{ \begin{array}{l} \text{£} \\ 660 \text{ A's stock.} \\ 540 \text{ B's stock.} \end{array} \right.$$

£ 1200 proof.

(5)

$$\text{First, } \left\{ \begin{array}{l} 50 \times 4 = 200 \\ 130 \times 3 = 390 \end{array} \right\} 590 \text{ A's products.}$$

$$\left\{ \begin{array}{l} 60 \times 6 = 360 \\ 20 \times 4 = 80 \end{array} \right\} 440 \text{ B's products.}$$

$$\left\{ \begin{array}{l} 100 \times 6 = 600 \\ 50 \times 5 = 250 \end{array} \right\} 850 \text{ C's products.}$$

sum 1880)362·0(·1925 com. multiplier;

$$\text{then, } \left\{ \begin{array}{l} 590 \\ 440 \\ 850 \end{array} \right\} \times 1925 = \left\{ \begin{array}{l} 113.575 \text{ A's share.} \\ 84.700 \text{ B's share.} \\ 163.625 \text{ C's share.} \end{array} \right.$$

proof £ 361·900 = 362l. 18s.

SIMPLE INTEREST.

(6)

$$\begin{array}{l} \text{First, } 64.5 \times 4.5 = 290.25 \quad \text{A's stock and time.} \\ 78.75 \times 6 = 472.5 \quad \text{B's stock and time.} \\ 112.7 \times 8.75 = 986.125 \quad \text{C's stock and time.} \\ 125.25 \times 5.25 = 657.5625 \quad \text{D's stock and time.} \end{array}$$

 \mathcal{L} 2406.4375 sum.

2406.4375)108.91875(045261 common multiplier;

$$\text{then, } \left\{ \begin{array}{l} 290.25 \\ 472.5 \\ 986.125 \\ 657.5625 \end{array} \right\} \times .045261 = \left\{ \begin{array}{l} 13.1370 \text{ A's gain.} \\ 21.3859 \text{ B's gain.} \\ 44.633 \text{ C's gain.} \\ 29.762 \text{ D's gain.} \end{array} \right.$$

$$\text{proof } \mathcal{L} \underline{\hspace{2cm}} \mathcal{L} \text{ s. d.} \\ 108.9179 = 108 18 \frac{4}{5}$$

SIMPLE INTEREST.

(1)

$$\begin{array}{l} \mathcal{L} \\ 364 \text{ principal.} \\ .05 \text{ ratio.} \end{array}$$

$$\underline{\hspace{2cm}} \quad 18.20 = 18l. 4s. \text{ ans.}$$

(2)

$$\begin{array}{l} \mathcal{L} \\ 486 \text{ principal.} \\ .05 \text{ ratio.} \end{array}$$

$$\begin{array}{l} \mathcal{L} \\ 24.30 \\ \hline 5 \text{ No. of years.} \end{array}$$

$$\mathcal{L} \underline{\hspace{2cm}} \quad 121.5 = 121l. 10s. \text{ ans.}$$

(3)

$$\begin{array}{r} \mathcal{L} \\ 884 \\ 7 \\ \hline 6188 \\ .05 \\ \hline 309.40 = 309l. 8s. \end{array}$$

(4)

$$\begin{array}{r} \mathcal{L} \\ 1001 \\ 6 \\ \hline 6006 \\ .045 \\ \hline 270.270 = 270l. 5s. 4\frac{3}{5}d. \end{array}$$

(5)

$$\begin{array}{r}
 \text{£} \\
 1205 \\
 -\cdot 5 \\
 \hline
 6025 \\
 -\cdot 04 \\
 \hline
 24\text{.}100 = 24\text{l. 2s.}
 \end{array}$$

(6)

$$\begin{array}{r}
 \text{£} \\
 640\text{.}4166 \\
 -\cdot 7 \\
 \hline
 4482\text{.}9162 \\
 -\cdot 05 \\
 \hline
 224\text{.}145810 = 224\text{l. 2s. 11d.}
 \end{array}$$

(7) $9640\cdot833 \times 4\cdot75 \times \cdot05 = 2289\cdot6978375 = 2289\text{l. }13s.\ 11\frac{1}{2}d.$

(8) $\cdot0001369863 \times 641 \times 50 = 4\cdot390410915 = 4\text{l. }7s.\ 9\frac{1}{2}d.$

(9) $\cdot00012928767 \times 2000 \times 69 = 15\cdot53424642 = 15\text{l. }10s.\ 8d.$

(10) $\cdot00010958904 \times 5800\cdot83 \times 260 =$

$$\begin{array}{r}
 165\cdot283921634832 \text{ interest.} \\
 5800\cdot83 \text{ principal.}
 \end{array}$$

$$\underline{\underline{5966\cdot113921634832 = 5966\text{l. }2s. 4d.}}$$

(11) $\cdot0001369863 \times 563\cdot627 \times 265 = 20\cdot4604319871765$
 $= 20\text{l. }9s.\ 2\frac{1}{2}d.$

NOTE. These questions are all proved by Simple Interest in Whole Numbers; see Interest, page 79.

(12) $5 \times \cdot04 = \cdot2$ product of ratio and time;
then, $12 + \cdot2 = 60\text{l.}$

(13) First, $4 \times \cdot05 = \cdot2$ product of ratio and time;
then, $124 + \cdot2 = 620\text{l.}$

(14) First, $3 \times \cdot05 = \cdot15$ product of ratio and time;
then, $69\cdot675 + \cdot15 = 464\cdot5 = 464\text{l. }10s.$

(15) $4\cdot5 \times \cdot04 = \cdot18$ product of ratio and time;
then, $58\cdot725 + \cdot18 = 326\cdot25\text{l.} = 326\text{l. }5s.$

SIMPLE INTEREST.

(16) $5 \times .04 = .2$ ratio and time;
add 1.

then, $\overline{1.2}$ divisor;

hence, $72 + 1.2 = 60l.$

(17) $4 \times .05 + 1 = .2 + 1 = 1.2$ divisor;
then, $744 + 1.2 = 620l.$

(18) $.05 \times 3 + 1 = .15 + 1 = 1.15$ divisor;
then, $534.175 + 1.15 = 464.5 = 464l. 10s.$

(19) $.04 \times 4.5 + 1 = 1.18$ divisor;
then, $384.975 + 1.18 = 326.25l. = 326l. 5s.$

(20) $60 \times .04 = 2.4$ product of principal and ratio;
then, $12 \div 2.4 = 5$ years.

(21) $620 \times .05 = 31$ divisor;
then, $124 + 31 = 4$ years.

(22) $464.5 \times .05 = 23.225$ divisor;
then, $69.675 + 23.225 = 3$ years.

(23) $326.25 \times .04 = 13.05$ divisor;
then, $58.725 + 13.05 = 4.5 = 4\frac{1}{2}$ years.

(24) First, $72 - 60 = 12$ dividend,
and, $60 \times .04 = 2.4$ divisor;
hence, $12 \div 2.4 = 5$ years.

(25) First, $620 \times .05 = 31$ divisor,
and, $744 - 620 = 124$ dividend;
then, $124 \div 31 = 4$ years.

(26) First, $464.5 \times .05 = 23.225$ divisor,
and, $534.175 - 464.5 = 69.675$ dividend;
then, $69.675 + 23.225 = 3$ years.

(27) First, $326.25 \times .04 = 13.05$ divisor,
and, $384.975 - 326.25 = 58.725$ dividend
then, $58.725 + 13.05 = 4.5 = 4\frac{1}{2}$ years.

(28) $12 \div \overline{60 \times 5} = 12 \div 300 = .04 = 4$ per cent.

$$(29) \quad 124 \div \overline{620} \times 4 = 124 \div 2480 = .05 = 5 \text{ per cent.}$$

$$(30) \quad 69.675 \div \overline{464.5 \times 3} = .05 = 5 \text{ per cent.}$$

$$(31) \quad 58.725 + \overline{326.25 \times 4.5} = .04 = 4 \text{ per cent.}$$

$$(32) \quad \frac{72 - 60}{60 \times 5} = \frac{12}{300} = .04 = 4 \text{ per cent.}$$

$$(33) \quad \frac{744 - 620}{640 \times 4} = \frac{124}{2480} = .05 = 5 \text{ per cent.}$$

$$(34) \quad \frac{534.175 - 464.5}{464.5 \times 3} = \frac{69.675}{1393.5} = .05 = 5 \text{ per cent}$$

$$(35) \quad \frac{384.975 - 326.25}{326.25 \times 4.5} = \frac{58.725}{1468.125} = .04 = 4 \text{ per cent.}$$

DISCOUNT.

Example (1) is worked.

(2)

First, $.05 \times 1 + 1 = 1.05l.$ amount of 1*l.* for the given time,
and $50 \times .05 \times 1 = 2.5l.$ interest of the debt;
then, $1.05l. : 1l. :: 2.5l. : 2.38l. = 2l. 7s. 7\frac{1}{4}d.$ disc.

(3)

First, $.05 \times 1 + 1 = 1.05l.$ amount of $1l.$ for the given time, and $200 \times .05 \times 1 = 10l.$ interest of the debt;

$$\text{then, } 105l. : 1l. :: 10l. : 9.5238 = \frac{l}{200} \begin{matrix} 9 & 10 \\ 0 & 0 \end{matrix} \begin{matrix} \text{L} \\ \text{s.} \\ \text{d.} \end{matrix} \begin{matrix} 5\frac{1}{2} \text{ disc.} \\ \text{principal.} \end{matrix}$$

diff. £ 190 9 6½ worth.

COMPOUND INTEREST.

(4)

First, $05 \times 25 + 1 = 1.0125$ amt. of 1*l.* for the given time,
and $36 \times 05 \times 25 = .45$ interest of the debt;

then, $1.0125l. : 1l. :: .45l. : .444 = \frac{\text{£ s. d.}}{36 0 0} \frac{\text{£ s. d.}}{8 10\frac{1}{2} 0}$ disc.
 $\underline{\hspace{1cm}}$ prin.

diff. $\text{£ } 35 11 \frac{1}{4}$ worth

(5)

First, $.045 \times 3 + 1 = 1.135$ amount of 1*l.* for the given time,
and $573.8 \times 045 \times 3 = 77.463$ interest of the debt;

then, $1.135l. : 1l. :: 77.463l. : 68.249l. = \frac{\text{£ s. d.}}{130 0 0} \frac{\text{£ s. d.}}{68 4 11\frac{3}{4}}$ dis.

First,

(6)

$.04375 \times 1.75 + 1 = 1.0765625$ amount of 1*l.* for the time,
and $130 \times .04375 \times 1.75 = 9.953125$ interest of the debt;

then, $1.0765625l. : 1l. :: 9.953125l. : 9.245l.$

$\frac{\text{£ s. d.}}{130 0 0} \frac{\text{£ s. d.}}{9 4 10\frac{1}{2}}$ disc.
 $\underline{\hspace{1cm}}$ prin.

$\text{£ } 120 15 1\frac{1}{4}$ present money.

(7)

First, $05 \times 2 + 1 = 1.01$ amount of 1*l.* for the given time,
and $399.666 \times 05 \times 2 = 3.99666$ interest of the debt;

then, $101l. : 1l. :: 3.99666l. : 3.975l.$

$\frac{\text{£ s. d.}}{399 13 4} \frac{\text{£ s. d.}}{3 19 1\frac{1}{2}}$ disc.
 $\underline{\hspace{1cm}}$ prin.

$\text{£ } 395 14 2\frac{1}{2}$ present worth of the bill.

COMPOUND INTEREST.

Example (1) is worked.

(2) $1.05 \times 1.05 \times 1.05 \times 1.05 \times 100 = 121.550625 = 121l.$
 $11s. 0\frac{1}{2}d.$ ans.

COMPOUND INTEREST.

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(3)

$$\begin{array}{r}
 \text{£} \\
 \begin{array}{r}
 \begin{array}{r}
 100 \text{ principal} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 00 \\
 \hline
 2 \cdot 5 \\
 + 100 \\
 \hline
 102 \cdot 5 = \text{1st half year's amount.} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 125 \\
 \hline
 2 \cdot 5625 \\
 + 102 \cdot 5 \\
 \hline
 105 \cdot 0625 = \text{2d half year's amount.} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 253125 \\
 \hline
 2 \cdot 6265625 \\
 + 105 \cdot 0625 \\
 \hline
 107 \cdot 6890625 = \text{3d half year's amount.} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 384453125 \\
 \hline
 2 \cdot 6922265625 \\
 + 107 \cdot 6890625 \\
 \hline
 110 \cdot 3812890625 = \text{4th half year's amt.} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 519064453125 \\
 \hline
 2 \cdot 7595322265625 \\
 + 110 \cdot 3812890625 \\
 \hline
 113 \cdot 1408212890625 = \text{5th half year's amt.} \\
 \cdot 05 \\
 \hline
 \end{array} \\
 \begin{array}{r}
 2) 5 \cdot 657041064453125 \\
 \hline
 2 \cdot 8285205322265625 \\
 + 113 \cdot 1408212890625 \\
 \hline
 \text{£ } 115 \cdot 9693418212890625 = 115 \text{l. 19s. } 4\frac{1}{2} \text{d.}
 \end{array}
 \end{array}
 \end{array}$$

(4)

£	100	principal.
	.05	
4)	5.00	
	1.25	
+ 100		
	101.25	= 1st quarter's amount.
	.05	
4)	5.0625	
	1.2656	
+ 101.25		
	102.5156	= 2d quarter's amount.
	.05	
4)	5.125780	
	1.281445	
+ 102.5156		
	103.797045	= 3d quarter's amount.
	.05	
4)	5.18985225	
	1.29746306	
+ 103.797045		
	105.09450806	= 4th quarter's amount.
	.05	
4)	5.2547254030	
	1.3136813507	
+ 105.09450806		
	106.4081894107	= 5th quarter's amount.
	.05	
4)	5.320409470535	
	1.330102367633	
+ 106.4081894107		
£	107.738291778333	= 107 <i>l.</i> 14 <i>s.</i> 9 <i>d.</i>

(5) $1 \cdot 04 \times 1 \cdot 04 \times 1 \cdot 04 \times 1 \cdot 04 \times 1 \cdot 04 \times 450 =$
 $547 \cdot 49380608$ amount in 5 years.
 450 principal.

~~2~~ $97 \cdot 49380608 = 97l. 9s. 11\frac{1}{2}d.$ the interest.

ARITHMETICAL PROGRESSION.

PROBLEM I.

Example (1) is worked.

(2) $\frac{33+3 \times 11}{2} = \frac{396}{2} = 198$ ans.

(3) $\frac{27+3 \times 7}{2} = \frac{210}{2} = 105s. = 5l. 5s.$

(4) $\frac{60+1 \times 60}{2} = \frac{3660}{2} = 1830$ yds. = 1 mile 70 yds.

PROBLEM II.

Example (1) is worked.

(2) $\frac{33-3}{11-1} = \frac{30}{10} = 3$ common difference.

(3) $\frac{27-3}{7-1} = \frac{24}{6} = 4s.$ difference per yard.

(4) $\frac{60-1}{60-1} = \frac{59}{59} = 1$ common difference.

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PROBLEM III.

Example (1) is worked.

(2)
$$\frac{83 - 3}{3} + 1 = 10 + 1 = 11$$
 the number of terms.

(3)
$$\frac{27 - 3}{4} + 1 = 6 + 1 = 7$$

(4)
$$\frac{60 - 1}{1} + 1 = 59 + 1 = 60$$

PROBLEM IV.

Example (1) is worked.

(2)
$$56 - \overline{19 - 1 \times 3} = 56 - 54 = 2$$
 the first term.

(3)
$$27 - \overline{7 - 1 \times 4} = 27 - 24 = 3$$
s. the first yard.

GEOMETRICAL PROGRESSION.

PROBLEM I.

Example (1) is worked.

(2)
$$\frac{8192 \times 2 - 2}{2 - 1} = 16382$$
 the sum of the series
ratio

(3)
$$\frac{2048 \times 2 - 1}{2 - 1} = 4095$$

(4)
$$\frac{32768 \times 4 - 2}{4 - 1} = \frac{131070}{3} = 43690$$
 sum of the series in
[farthings;
then, 43690 far.= 45l. 10s. 2½d.

PROBLEM II.

Example (1) is worked.

- (2) First, $\begin{cases} 1. 2. 3. 4. 5. 6. 7. \text{ indices.} \\ 2. 4. 8. 16. 32. 64. 128. \text{ terms.} \end{cases}$

Then, $7+6=13$ number of terms;
and, $128 \times 64=8192l.$

- (3) First, $\begin{cases} 0. 1. 2. 3. 4. 5. 6. \text{ indices.} \\ 1. 2. 4. 8. 16. 32. 64. \text{ terms.} \end{cases}$

Then, $6+5=11$ number of terms less;
and, $64 \times 32=2048s.=102l. 8s.$ the last payment;
then, $2048-1=2047+2048=4095s.=204l. 15s.$ the debt.

- (4) First, $\begin{cases} 0. 1. 2. 3. 4. \text{ indices.} \\ 2. 8. 32. 128. 512. \text{ terms.} \end{cases}$

and, $4+3=7$ number of terms less;
Then, $\frac{512 \times 128}{2}=32768$ eldest child's fortune;
and, $\frac{32768 \times 4-2}{4-1}=\frac{131070}{3}=43690l.$ the whole estate.

PERMUTATION.

Example (1) is worked.

- (2) $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9=362880$ days.
(3) $1 \times 2 \times 3 \times 4 \times 5 \times 6=720$ positions;
and, $720+2=360$ days.
(4) $1 \times 2 \times 3 \times 4 \times 5 \times 6=720$ changes.

SINGLE POSITION.

SINGLE POSITION.

Example (1) is worked.

$$(2) \left\{ \begin{array}{l} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{2} \end{array} \right\} \text{ of } 60 \text{ crowns} = \left\{ \begin{array}{l} 30 \\ 20 \\ 12 \end{array} \right\}$$

sum 62 but should be 60;

$$\therefore 62 : 60 :: \left\{ \begin{array}{l} 30 \\ 20 \\ 12 \end{array} \right\} : \left\{ \begin{array}{l} 29 \frac{2}{3} \\ 19 \frac{1}{3} \\ 11 \frac{1}{3} \end{array} \right\}$$

A's share.
B's share.
C's share.

crown 60 proof.

(3) Suppose he had 120*l.* at first;

$$\text{then, } \left\{ \begin{array}{l} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{2} \end{array} \right\} \text{ of } 120 = \left\{ \begin{array}{l} 40 \\ 30 \\ 24 \end{array} \right\}$$

94 sum, which
taken from 120

leaves 26 which should be 104.

$$\therefore 26l. : 104l. :: 120l. : 480l. \text{ the sum he had}$$

[at first.]

(4) Suppose he lent 5*l.*;then, $5 \times .05 \times 20 = 5s.$ interest for 1 year;

$$\text{and, } 12 \times 5s. = 60 = \begin{array}{r} \text{£} \\ 3 \\ 0 \end{array} \quad \begin{array}{r} \text{d.} \\ 0 \\ 0 \end{array}$$

interest for 12 years.

5 0 0 principal.

$$\text{£} \ 8 \ 0 \ 0 \text{ amt. but should be } 500l.$$

$$\therefore 8l. : 5l. :: 500l. : 312l. 10s. \text{ the sum lent.}$$

(5) Suppose the work be done in 24 days;
 then, $\left\{ \begin{array}{l} 12 \\ 8 \\ 6 \end{array} \right\} : 1 :: 24 : \left\{ \begin{array}{l} 2 \text{ days done by A.} \\ 3 \text{ days done by B.} \\ 4 \text{ days done by C.} \end{array} \right\}$
 sum 9 by them all.

∴ 9 d. : 24 d. : 1 d. : $2\frac{1}{3}$ days by A, B, and C's working together.

DOUBLE POSITION.

Example (1) is worked.

(2)

\mathcal{L}	\mathcal{L}
300	300
Suppose B's share 80	Suppose B=100
then A's share is 220	A=200
diff. 140	diff. 100
should be 72	should be 72
1st error + 68	2d error + 28
2d sup. 100	1st sup. 80

$$\begin{array}{r} \text{1st product } 6800 \\ \text{2240} \\ \hline \end{array} \qquad \begin{array}{r} \text{2d product } 2240 \\ \hline \end{array}$$

$$68 - 28 = 4 | 0) 456 | 0$$

$$114 = \text{B's share.}$$

$$300$$

$$\text{diff. } 186 = \text{A's share.}$$

$$\mathcal{L} \quad 72 \text{ proof.}$$

DOUBLE POSITION.

	(3)		
First, suppose A	£ 240	Second, sup.	£ 260
+ 50	<hr/>	50	<hr/>
B had left	290	310	282
+ 50	<hr/>	50	<hr/>
B had at first	340	360	332
+ 44	<hr/>	44	<hr/>
B has now	384	404	376 B's m.
A has left	196	216	188
double	392	432	376
<hr/>		<hr/>	
1st error + 8	2d error + 28		proof.
2d sup. 260	1st sup. 240	<hr/>	
<hr/>		<hr/>	
1st pro. 2080		1120	
<hr/>		56	
		<hr/>	
	28 6720 2d product.		
	8 2080	<hr/>	
	<hr/>	20)464 0	
	<hr/>		
	£ 232 A's money.		

DOUBLE POSITION.

153

(4)

First, suppose A worked 10 days at 32d. per day = 320
 then, B worked 20 days at 26d. = 520

sum 840
should be 3l. 14s. = 888

1st error - 48

Second, suppose A worked 15 days at 32d. = 480
 then, B worked 15 days at 26d. = 390

sum 870
should be 888

2d error - 18

1st error - 48	2d error - 18
2d sup. 15	1st sup. 10

1st error 48	720 prod.	180 prod.
2d error 18	180	

diff. 3|0)54,0

18 days A worked.

12 days B worked.

sum 30

Now { 18 days at 32 = 576
 12 days at 26 = 312

proof 888 = 3l. 14s.

DOUBLE POSITION.

(5)

First, suppose A owes $\frac{2}{3}$
then, B owes 70

100

But A's 30
C's 90

sum 120
should be 140

1st error - 20

Then, if B owes $\frac{2}{3}$
C owes 90

160

Second, suppose A owes 52
then, B owes 48

100

But A's 52
C's 112

2d sup. 52
1st error - 20

sum 164
should be 140

errors { 24 1040
 20 720

2d error + 24
1st sup. 30

44)1760(40l. A's debt.
 176 60 B's debt.
 — 100 C's debt.

prod. 720

0 —
200 sum.

A's 40 + B's 60 = 100l. B's 60 + C's 100 = 160l. A's 40 +
C's 100 = 140l. proof.

MISCELLANEOUS QUESTIONS. 155

First, sup. Ist letter's place is 9 (6)
 then, the 2d is 3
 and the 3d is 46 2d, sup. 1st let. place is 6
 then, the 2d is 2
 and the 3d is 31

sum 58	sum 39
should be 20	should be 20
—	—

1st error + 38	2d error + 19
2d sup. 6	1st sup. 9
—	—

38 228	171
19 171	—
—	—

19) 57 (3 the first letter's place.
 57
 —

First letter's place = 3=C
 the second = 1=A
 the third = 16=P } ... { C A P is the orna-
 ment.

sum 20 proof.

MISCELLANEOUS QUESTIONS.

(1)
 80 least number.
 28 difference.

—
 108 greater number.
 80

Ans. 188 sum of both.

(2)
 20 left
 21 } stolen 3 } night
 42 } the 2 }
 84 } 1 }

—
 167 sheep at first.

(3)

From the Creation to the Flood	1656
To the building of Solomon's temple	1336
To Mahomet	1630
	—
	4622
Mahomet after Christ	— 622
	—
A. M.	4000
	—

(4)

$$\begin{aligned} 1787 - 1765 &= 22 + 24 = 46 \text{ C's} \\ 17 + 46 &= 63 \text{ A's} \\ 13 + 63 &= 76 \text{ B's} \end{aligned} \left. \begin{array}{l} \\ \} \text{age.} \\ \end{array} \right\}$$

(5)

Distance of the sun from the earth	81000000
Distance of the earth and moon	+ 240000
	—
From each other in an eclipse of the moon	81240000
	—
	81000000
	- 240000
From each other in an eclipse of the sun	80760000
	—

(6)

Temple built A. M. 3000	Christ born A. M. 4000
Troy before — 443	Rome built before — 744
	—
Troy built A. M. 2557	A. M. 3256
London after + 260	Carthage built bef. — 113
	—
London built A.M. 2817	A. M. 3143
	—
	London built 2817
	—
London older than Carthage	326 years
	—

MISCELLANEOUS QUESTIONS. 157

(7)

$$\begin{array}{r}
 \text{From the whole debt} & \text{\pounds} & \text{s.} & \text{d.} \\
 16 & 13 & 0 \\
 \text{Take the difference of their payments} & - & 6 & 13 & 3 \\
 \hline
 & 2) & 9 & 19 & 9
 \end{array}$$

$$\begin{array}{r}
 \text{The half is what A has now to pay} & 4 & 19 & 10\frac{1}{2} \\
 \text{A has paid more than B} & + & 6 & 13 & 3 \\
 \hline
 & 11 & 13 & 1\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 \text{Sum is what B has to pay} \\
 \hline
 \end{array}$$

(8)

First, $81000000 - 59000000 = 22000000$ miles, the distance
the earth is from Venus when in perigæo.

And, $81000000 + 59000000 = 140000000$ miles, the dis-
tance the earth is from Venus, when in apogæo.

$$140000000 - 22000000 = 118000000 \text{ miles.}$$

(9)

$$\begin{array}{l}
 \text{First, } 46 \times 46 = 2116 \\
 \text{and, } 32 \times 12 = 384
 \end{array}$$

1732 the no. req.

$$\begin{array}{r}
 \text{\pounds} & \text{s.} & \text{d.} \\
 18 & 6 & 4\frac{1}{2} \\
 & 12 & \\
 \hline
 219 & 16 & 6
 \end{array}$$

(11)

$$\begin{array}{r}
 \text{First, } 35 \times 2 = 70 \\
 \text{and, } 5 \times 2 + 30 = 40
 \end{array}$$

30 diff.

(12)

First, $20 + 423 + 19 = 462$, the divisor;
then, $423 \times 462 + 20 = 195446$, the dividend.

MISCELLANEOUS QUESTIONS.

(13)
First, $109 \times 73 = 7957$ the greater number;
and, $28 \times 17 = 476$ difference;

$$\overline{7481} \text{ less number.}$$

Then, $7957 + 7481 = 15438$ their sum;
also, $7957 \times 7481 = 59526317$ their product.

	£
Merchant's whole stock	13000
Gain per annum $364 \times 4 =$	1456
Ditto $586 \times 3 =$	1758
Ditto $873 \times 3 =$	2619
His whole gain	<u>5833</u>
His original stock to begin with	<u>7167</u>

	£
To his widow	10000
To a charity	1693
To nephews $2460 \times 3 =$	7380
To nieces $2100 \times 4 =$	8400
To 20 poor housekeepers	210
To executors	420
	<u>28103</u>

(16)
First, $4429 + 43 = 103$; then, $240 - 103 = 137$.

(17)
First, $2262 + 26 = 87$, and $2262 + 87 = 26$;
then, $87 - 26 = 61$.

$$(18) \quad 5190048 + 72084 = 72.$$

(19)

$$\begin{array}{r} \text{£ s. d.} \\ 8) 12 \ 8 \text{ worth of both.} \\ \quad 1 \ 7 \text{ worth of the purse.} \\ \hline \end{array}$$

11 1 cash in the purse.

(20)

	£	s.	d.
A and B had	13	10	0
B and C	12	12	0
A and C	11	16	6
sum	<u>37</u>	<u>18</u>	<u>6</u>

which being divided by the number of players at each time, will give the sum won, viz.

$$\begin{array}{r} \text{£ s. d.} \\ 37 \ 18 \ 6 + 2 = 18 \ 19 \ 8 \text{ what was won; } \end{array}$$

$$\text{then, from } \left\{ \begin{array}{l} \text{£ s. d.} \\ 18 \ 19 \ 8 \end{array} \right\} \text{ take } \left\{ \begin{array}{l} \text{£ s. d.} \\ 13 \ 10 \ 0 \\ 12 \ 12 \ 0 \\ 11 \ 16 \ 6 \end{array} \right\} \text{ remain } \left\{ \begin{array}{l} \text{£ s. d.} \\ 5 \ 9 \ 3 \text{ C's gain} \\ 6 \ 7 \ 3 \text{ A's gain} \\ 7 \ 2 \ 9 \text{ B's gain} \end{array} \right\}$$

(21) First, $\frac{1}{3}$ of 6 = 2, and $\frac{1}{3}$ of 20 = 5; then, as 2 : 3
 $\therefore 5 : 7\frac{1}{2}$.

(22) First, $\frac{3}{8}$ of $\frac{1}{2} = \frac{3}{16}$, sold: then as $\frac{3}{16} : 1\frac{1}{4} \text{ or } \frac{7}{4}$
 $\frac{3}{8} : 8\frac{2}{5} = 3800\text{l.}$

(23) Here, A goes only $\frac{1}{2}$ of the circumference in an hour, and B goes the whole circumference in an hour; so B gains $\frac{1}{2}$ of A in that time; then,

$$\begin{array}{r} \text{cir.} \quad h. \quad \text{cir.} \quad h. \quad h. \text{ min.} \\ \text{as } \frac{1}{2} : 1 :: 1 : \frac{1}{2} = 1 \ 5\frac{1}{2} \end{array}$$

160 MISCELLANEOUS QUESTIONS.

(24)

First, $8-5=3$ miles, B gains of A in one day.
and, $10-5=5$ miles, C gains of A in one day.

Then, $\frac{m}{d} : \frac{m}{d} :: \frac{73}{24\frac{1}{2}}$ when A and B meet;
also, $\frac{m}{d} : \frac{m}{d} :: \frac{73}{14\frac{1}{2}}$ when A and C meet;
and B and C can never meet with A but at the end of
these periods.

∴ B and C can never both meet with A but when
some number of B's periods is equal to some number
of C's periods. Therefore, find two whole numbers
which are in the same proportion as $24\frac{1}{2}$ to $14\frac{1}{2}$, which
will be 365 and 219; ∴ after 365 of B's periods, or 219
of A's, all three men will meet again, and not before;
∴ the time of meeting is $219 \times 24\frac{1}{2} = 5329$ days.

(25)

$\frac{h}{cis.} : \frac{h}{cis.} :: \frac{22}{2\frac{1}{4}}$; then $2\frac{1}{4}-1=1\frac{1}{4}$
∴ as $1\frac{1}{4}$ c. : 22 h. : : 1 c. : $12\frac{1}{4}$ hours.

(26)

First, $13^\circ - 1 = 12^\circ$ moon gains of the sun per day;
and, $30^\circ \times 3 = 90^\circ$ from 1st of Aries to 1st of Cancer;
also, $90^\circ + 3 = 93^\circ$ sun before the moon; then,

as $12^\circ : 1^\circ :: 93^\circ : 7\frac{1}{4}^\circ$ moon overtakes the sun.
∴ $7\frac{1}{4} + 3 = 10\frac{1}{4}$ degrees of Cancer.

(27)

First, $3+5=8$, then, as $8 : 400 :: 3 : 150$. less farm.
 $8 : 400 :: 5 : 250$. greater farm.

(28)

First, $3+5+8=16$; then,
 $16 : 2000 :: \left\{ \begin{array}{l} 3 \\ 5 \\ 8 \end{array} \right\} : \left\{ \begin{array}{l} 375 \\ 625 \\ 1000 \end{array} \right\}$ A's share.
B's share.
C's share.

£ 2000 proof.

(29)

A can do $\frac{1}{3} = \frac{16}{48}$
 B can do $\frac{1}{8} = \frac{6}{48}$
 C can do $\frac{1}{12} = \frac{4}{48}$

Their sum $\frac{16+6+4}{48} = \frac{26}{48}$ work, all working together one week.
 $\therefore \frac{26}{48}$ work : 6 days :: 1 work : $\frac{48}{26}$ days = 5 days 4 hours.

(30)

While A works $1 = \frac{105}{105}$
 B works $\frac{1}{3} = \frac{35}{105}$
 C works $\frac{1}{5} = \frac{21}{105}$
 D works $\frac{1}{7} = \frac{15}{105}$

their sum $\frac{105}{105}$, in an hour together.

$\therefore \frac{105}{105} : 1 : : 3 : \frac{105}{105} = 1\ 47' 23\frac{2}{11}''$

(31)

First, $81000000 \times 81000000 = 6561000000000000$

then, recip. as

1 : 6561000000000000 :: 2 : 3280500000000000

$\therefore \sqrt{3280500000000000} = 57275649$ miles.

(32)

First, $13\cdot5 - 7\cdot5 = 6$ inches difference;
 then, as 4 : 9 :: 6 : 13·5 lb.

(33)

First, $11 \times 11 = 121$, and the square of 1 is 1; then,
 as 1 : 16·083 :: 121 : 1946·083 feet.

$1 = 16\cdot083$ $3 = 48\cdot25$ $5 = 80\cdot416$ $7 = 112\cdot583$ $9 = 144\cdot75$ $11 = 176\cdot916$ $13 = 219\cdot083$ $15 = 241\cdot25$ $17 = 273\cdot416$ $19 = 305\cdot583$ $21 = 337\cdot75$	in the <table border="0" style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">1st</td><td>2d</td></tr> <tr> <td>3d</td><td>4th</td></tr> <tr> <td>5th</td><td>6th</td></tr> <tr> <td>7th</td><td>8th</td></tr> <tr> <td>9th</td><td>10th</td></tr> <tr> <td>11th</td><td></td></tr> </table> sec. of time.	1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	
1st	2d												
3d	4th												
5th	6th												
7th	8th												
9th	10th												
11th													

1946·083 as before

(34)

Thus, as, $16.083 : 1^2 :: 400 : 24.877$
 $\therefore \sqrt{24.877} = 4.987 +$, or 5 seconds nearly.

(35)

	stud.	days	stud.
Here	$4 : 40$::	12
	$14\text{ h.} :$::	10 h.
	<hr/>	<hr/>	<hr/>
	56		120
	40		<hr/>
	<hr/>	<hr/>	<hr/>
12 0)224 0			
	<hr/>	<hr/>	<hr/>
	18 $\frac{2}{3}$	days.	
	<hr/>	<hr/>	<hr/>

(36)

First, as $9 : 14 :: 31 : 48\frac{2}{3}$ fills in 31 minutes;
then, $48\frac{2}{3} - 40 = 8\frac{2}{3}$ gallons in the tub at the end of
31 minutes, and from 2 to 5 = 3 hours, or 180 minutes.

Again, as $31 : 8\frac{2}{3} :: 180 : 47\frac{2}{3}$ fills in 3 hours;
and, $147 - 47\frac{2}{3} = 99\frac{8}{3}$ gallons, wants of being full.

Also, as $14 : 9 :: 99\frac{8}{3} : 63\frac{48\frac{2}{3}}{4}$ the tub will
be full; which, added to 5 o'clock, will give 3 minutes
 $48\frac{2}{3}\frac{2}{3}$ seconds after 6 the tub will be full.

MISCELLANEOUS QUESTIONS. 163

(37)

Discharges are here made in proportion to the square root of the height of the column of water, and the square of the diameter of the discharging pipe from that column.

Therefore, the square root of $25=5$; square root of $1=1$; square root of $16=4$; and square of $2=4$.

$$\begin{array}{r} f. \quad h. \quad f. \\ 5 \longrightarrow 1000 \longrightarrow 4 \\ 1 \text{ in.} \longrightarrow 4 \text{ inches.} \\ 40 \text{ hour} \longrightarrow 24 \text{ hours.} \end{array}$$

$$\text{Then, } \frac{1000 \times 4 \times 4 \times 24}{5 \times 40} = \frac{384000}{200} = 1920 \text{ hogsheads.}$$

(38)

$$150 : 560 :: \left\{ \begin{array}{l} \mathcal{L} 40 \\ 50 \\ 60 \end{array} \right\} : \left\{ \begin{array}{l} \mathcal{L} 149\frac{1}{2} \\ 186\frac{3}{4} \\ 224 \end{array} \right\} \begin{matrix} \text{A's stock.} \\ \text{B's stock.} \\ \text{C's stock.} \end{matrix}$$

$\mathcal{L} 560$ proof.

(39)

First, A's stock $\frac{\mathcal{L}}{time} 168$
time 5 months.

$$18 : 840 :: 12 : 70 \text{ B's stock.}$$

Secondly, as $18 : 840 :: 60 : 7$ months, C's time.

(40)

As $100 : 20 :: 400 : 80$ for A.

Then, as $80 : 12 :: 50 : 7\frac{1}{2}$ A's time.

$B's \text{ time } A's \text{ stock } A's \text{ time } B's \text{ stock}$
And, as $5 : 400 :: 7\frac{1}{2} : 600$

(41)

$$\begin{aligned}
 100+ & 5=20 \\
 300+ & 8=37\cdot 5 \\
 600+ & 12=50 \\
 1000+ & 15=66\cdot 666
 \end{aligned}$$

sum $174\cdot 166$) $300\cdot 000$ ($1\cdot 72248$ common multiplier

$$\begin{aligned}
 1\cdot 72248 \times 20 & =34\cdot 45 \text{ acres, A's share.} \\
 1\cdot 72248 \times 37\cdot 5 & =64\cdot 593 \text{ acres, B's share.} \\
 1\cdot 72248 \times 50 & =86\cdot 124 \text{ acres, C's share.} \\
 1\cdot 72248 \times 66\cdot 666 & =114\cdot 832 \text{ acres, D's share.}
 \end{aligned}$$

proof $300\cdot 000$ acres.

(42)

First, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, reduced to a common denominator, will be $\frac{20}{60}$, $\frac{15}{60}$, and $\frac{12}{60}$.

and, $20+15+12=47$ by rejecting the denominators.

Then, as $47 : 100000 :: \begin{cases} 20 : 42553\frac{9}{17} \\ 15 : 31914\frac{1}{17} \\ 12 : 25531\frac{1}{17} \end{cases}$ A's part. B's part. C's part

But $25531\frac{1}{17}$. C's part being lost by his death, it must be divided between the other two in proportion as 4 to 3;

viz. $4+3=7 : \begin{cases} 25531\frac{1}{17} : 4 : 14589\frac{11}{17} \\ 25531\frac{1}{17} : 3 : 10942\frac{8}{17} \end{cases}$

$$\therefore 42553\frac{9}{17} + 14589\frac{11}{17} = 57142\frac{10}{17} \text{ A's part.}$$

$$\text{And, } 31914\frac{1}{17} + 10942\frac{8}{17} = 42857\frac{11}{17} \text{ B's part.}$$

$\mathcal{L} 100000$ proof.

(43)

Take a number at pleasure and divide it in proportion to their shares, then proceed by the single rule of false.

A 120

B 80

C 75

D 72

$$\frac{347}{\text{---}} : 2000 :: \left\{ \begin{array}{l} 120 : 691\frac{2}{3} \text{ A's share.} \\ 80 : 461\frac{3}{4} \text{ B's share.} \\ 75 : 432\frac{3}{4} \text{ C's share.} \\ 72 : 414\frac{3}{4} \text{ D's share.} \end{array} \right.$$

~~2000~~ proof.

(44)

18 months.

 $5=9-4$ mo. $\frac{\text{---}}{90}$

10 acres.

3)900

 $3\frac{1}{3}$ acres. $\frac{\text{---}}{2700}$

300

diff. 3000

21 oxen.

 $\frac{\text{---}}{9}$ mo. $\frac{\text{---}}{189}$ $14=18-4$ mo. $\frac{\text{---}}{2646}$

24 acres.

 $\frac{\text{---}}{10584}$

5292

 $\frac{\text{---}}{3)63504}$ $3\frac{1}{3}$ acres. $\frac{\text{---}}{190512}$

21168

 $\frac{\text{---}}{211680}$ $\frac{\text{---}}{-103680}$ $\frac{\text{---}}{\$1000)$

108000

 $\frac{\text{---}}{36 \text{ oxen.}}$

12 oxen.

 $\frac{\text{---}}{4}$ mo. $\frac{\text{---}}{48}$

9 mo.

 $\frac{\text{---}}{432}$

24 acres.

 $\frac{\text{---}}{1728}$

864

 $\frac{\text{---}}{10368}$

10 acres

 $\frac{\text{---}}{103680}$

166 MISCELLANEOUS QUESTIONS

(45)

First, suppose 10=the number of the whole company at first.

Then, $10 \times 13s. = 130s.$ the whole reckoning.

Taking 3 away, 7 remains at $19\frac{1}{2}s. = 196\frac{1}{2}s.$
Should be equal to the whole reckoning = 130

first error too much, + $6\frac{1}{2}$

Second, suppose 20=the number at first.

Then, $20 \times 13s. = 260s.$ the whole reckoning.

Taking out 3, remains 17, at $19\frac{1}{2}s.$ a-piece = $391\frac{1}{2}s.$
Should be equal the whole reckoning = 260

second error too much, + $71\frac{1}{2}$
 $6\frac{1}{2} \times 20 = 130$ take
 $71\frac{1}{2} \times 10 = 715$ from

65 65)585(9 at first.
 585

Hence, 9 at 13s. each = 117 the reckoning. } Proof.
6 at $19\frac{1}{2}s.$ each = 117 the same. }

(46)

From the nature of the question, it appears that the increase in the first year will be 0, in the second year 1, in the third year 1, in the fourth year 2, in the fifth year 3, in the sixth year 5, and so on to 40 years, or terms (each term being = to the sum of the two next preceding ones); whence the two last terms are 39088169 and 63245986, and the sum of them all (or the whole series) = $2 \times 63245986 + 39088169 - 1 =$ 165580140, the increase required.

(47)

By the nature of the question, it appears that the increase in the third year will be 1, in the fourth year 1, in the fifth year 1, in the sixth year 2, in the seventh year 3, and so on to 20 years, or terms (each term being = to the sum of the last term and the next but one preceding); whence the three last terms are 189, 277, and 406, and the sum of them all (or the whole series) = $2 \times 406 + 277 + 189 = 1278$ whole stock.

THE END.

LONDON :
Printed by A. & R. Spottiswoode,
New-Street-Square.





